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AERO DIGEST

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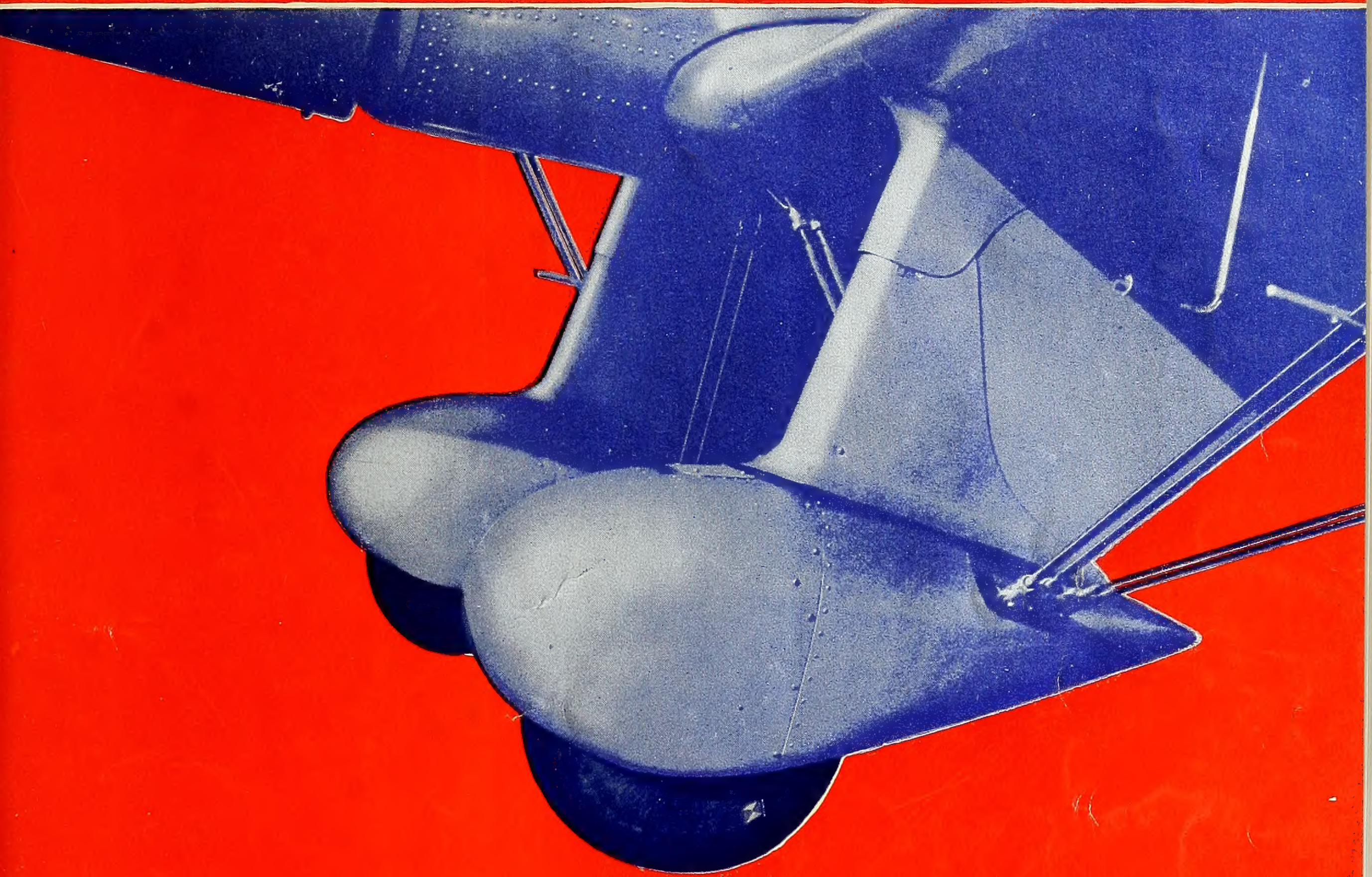
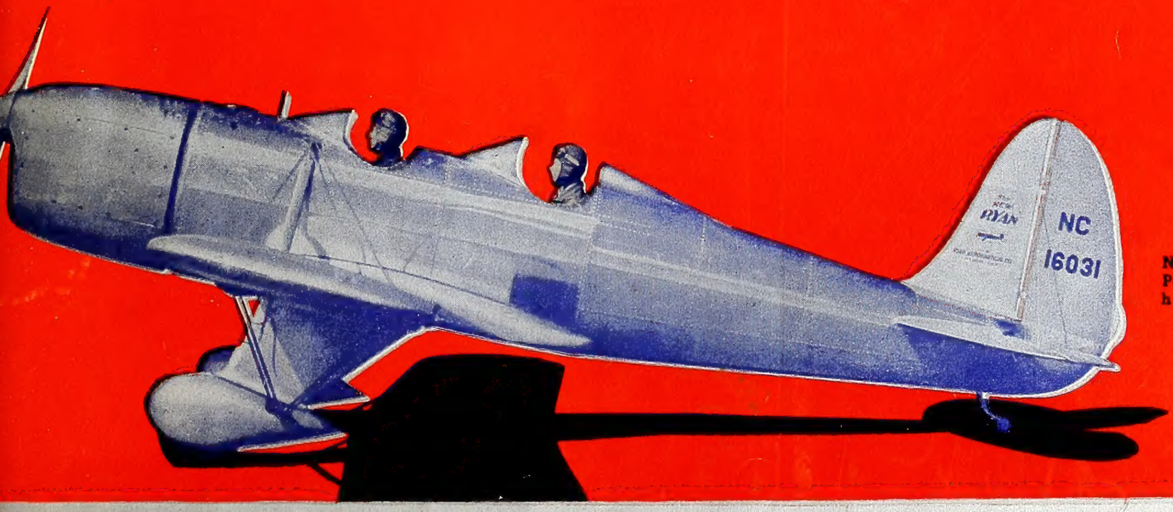


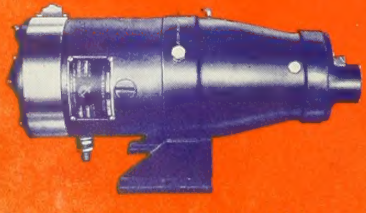


New Ryan S-T
Powered by 125
h.p. Menasco

cond Annual Digest of Aircraft & Engine Materials

Eclipse advances the development of hydraulic control with NEW HYDRAULIC PUMPS

Eclipse Engine Driven Hydraulic Pump



Eclipse Electric Motor Driven Hydraulic Pump for 12 or 24-volt operation

THE Eclipse Engine Driven and Electric Motor Driven Hydraulic Pumps are now available, after extended development and exhaustive tests. They provide a reliable oil pressure source for the hydraulic control of retractable landing gear, wing flaps and retractable wing tips or floats. The design principle employed assures the maintenance of high operating pressures with minimum service requirements.

ECLIPSE AVIATION CORPORATION

EAST ORANGE, NEW JERSEY

(Subsidiary of Bendix Aviation Corporation)

AERO DIGEST, July, 1936
Volume 29 Number 1

Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.

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NATIONAL PARKS AIRWAYS, Inc.

THE YELLOWSTONE PARK AIRLINE

April 13 1936.

Mr. Richard Goldsmith,
President,
136 West 52nd St.,
New York City.

Dear Mr. Goldsmith:

Our Boeing 247-D airplanes, flying between Salt Lake City and Great Falls, Montana, are equipped with B. G. Spark Plugs, and we cannot refrain from complimenting you upon the excellence of your product.

In our operations, we experience wide variations of and even below zero temperatures, and under the most strenuous of service conditions, the B. G. Spark Plug has proved dependable and exceptionally satisfactory.

Very truly yours,

NATIONAL PARKS AIRWAYS, INC.

By A. W. Stephenson
A. W. Stephenson
Manager of Operations

Above: **Flying over Jackson Lake. Teton Peaks in background.**

Below: **National Parks Airways ten-passenger, twin-engine Boeing "247 D"—Pratt & Whitney powered. This type of equipment is flown on every NPA schedule.**

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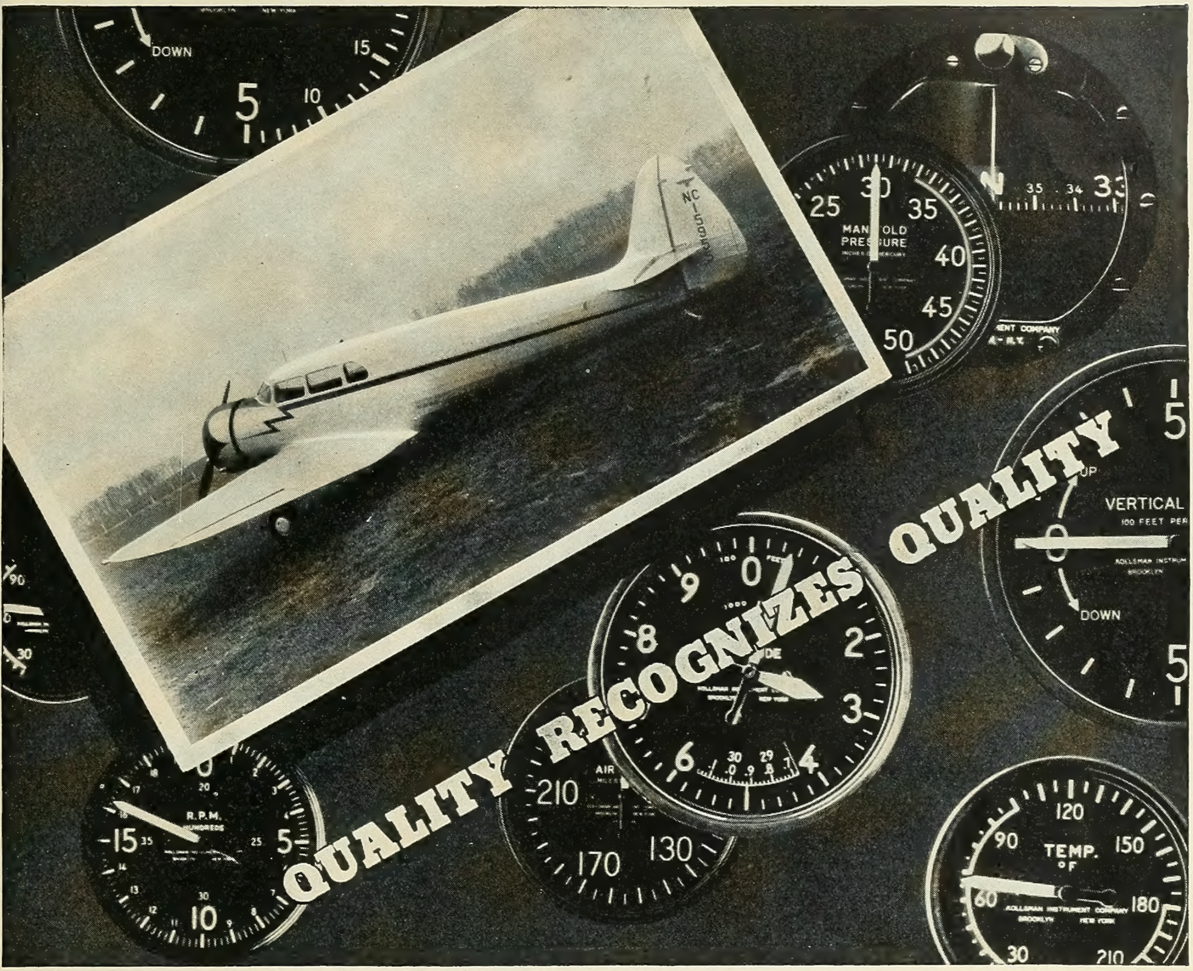

"45" Cabin by **Fairchild**—Instruments by **Kollsman**

In every detail, including its Kollsman-equipped instrument panel, the new "45"—fast, luxurious airplane for the private owner—upholds traditional Fairchild quality. The choice of instruments was dictated by Kollsman precision, Kollsman reliability.

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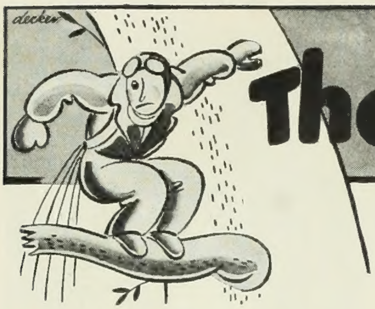
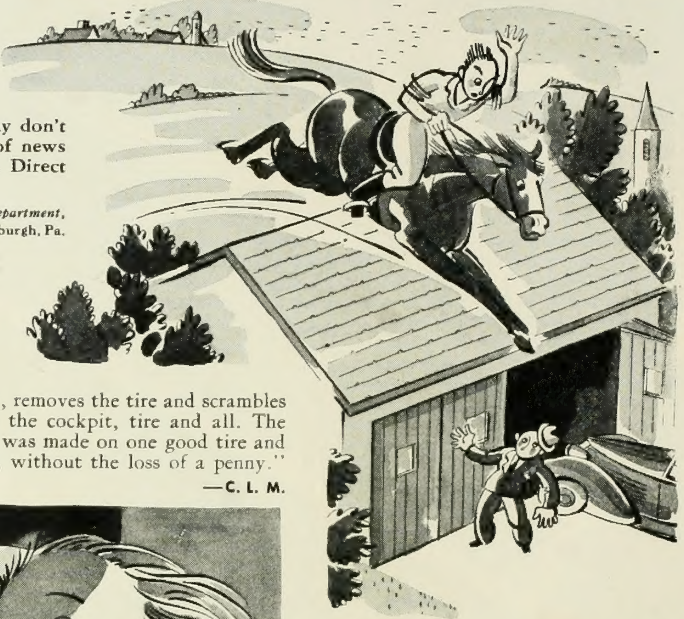


The Birdmen's Perch

After you've dashed through this page, fellows, why don't you sharpen your goose quill and send us a bit of news about yourself or your friends? We live on gossip. Direct your correspondence to

MAJOR AL WILLIAMS, *Manager, Aviation Department,*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.



LOST:

ONE TOUPEE—Somewhere in the vicinity of Pittsburgh lies a handsome iron gray wig, size 7 1/8. It was last seen floating earthward by its owner on a fine May day of this year.

This gentleman, who prefers to remain anonymous, was taking a flight with Major Al Williams, when Major Al got frisky and decided to try a little upside down flying.

Will finder please mail toupee to 3800 Gulf Building, Pittsburgh, Pa. *Soon,* too. The gentleman is getting impatient.

TEXAS STRANGER

Higgins, Texas, is way out in the Panhandle country where the land looks up hill in every direction.

A few weeks ago an airplane from Kingfisher, Oklahoma, made a forced landing on the edge of the little town, taxied up to dealer Paul Patton's station. Here it was serviced with That Good Gulf Gasoline, and took off for parts unknown.

Paul is waiting for the stranger to return. Figures that once he's used That Good Gulf he'll want to make a habit of it.

SCOTCHMAN?

"Your squib about the 'mildly disturbed' barnstormer in the February Perch sounded like a re-hash of an incident that happened to a friend of mine about 1923-25.

"This friend was a wing-walker and acrobat with a famous flying circus. While en route to a new location with his brother as pilot, a tire blew out in mid-air.

"Tires were scarce, and expensive! So our birdman hops out of the cockpit, climbs over the wing and on to the landing gear, removes the tire and scrambles back to the cockpit, tire and all. The landing was made on one good tire and the rim, without the loss of a penny."

—C. L. M.

HOW TO TAME HAIRS

"I, too, like Ted R., put Gulf Aviation Gas on my hair, and then couldn't stop it from growing. Finally, I found a remedy.

"Before retiring, you wash your head in salt water and do not rinse it out. Then when you go to bed you set a glass of water on a table beside the bed. The hair roots are made thirsty by the salt water bath and come out to get a drink.

"While the roots are slaking their thirst, you sneak up on them and tie a knot in each. This keeps them from going back in your scalp. A few nights' work and you can be bald and blissful again."

—G. E. K.

19,000 MILES A DAY

Twenty-five major cities of the East are served by the Douglas and Lockheed airliners of Eastern Airline's "Great Silver Fleet." These planes fly 19,384 scheduled miles daily, using those two great Gulf products, *Gulf Aviation Gasoline* and *Gulfpride Oil.*

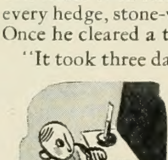
THIS MONTH'S WHOPPER

"I ride horseback when I'm not flying, and a couple of weeks ago I had a horse that simply refused to go. I broke three riding crops and my New Year's resolutions just getting the beast into a slow walk.

"Last week I rode again and they gave me the same horse, but I was prepared. Before we started I fed the animal ten lumps of sugar soaked in Gulf Aviation gas.

"The trick worked. We raced along the trail, passing every car on the parkway. The horse then left the trail and jumped every hedge, stone-wall and fence in sight. Once he cleared a two-car garage.

"It took three days for me to slow him down enough to get back to the stable. I've been eating off the mantle piece ever since.



"If any of your friends have trouble making their horses go, half a lump of sugar just held near Gulf Aviation gas would be plenty."

—J. W.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

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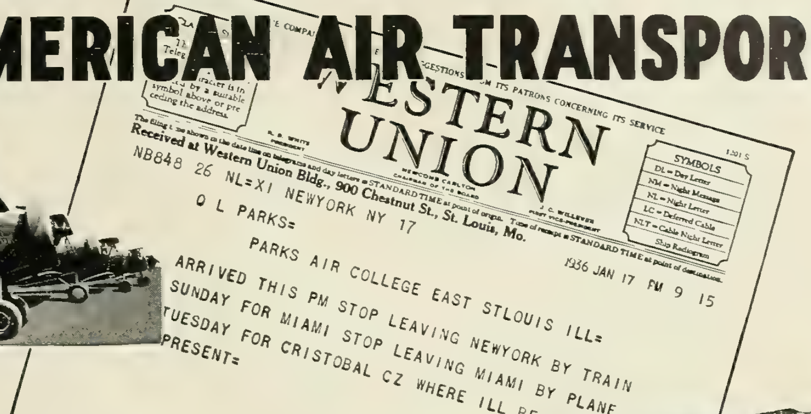
From PARKS AIR COLLEGE to SOUTH AMERICAN AIR TRANSPORT

4 of the 10 Parks Training Planes



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PARKS AIR COLLEGE EAST STLOUIS ILL=

ARRIVED THIS PM STOP LEAVING NEWYORK BY TRAIN SUNDAY FOR MIAMI STOP LEAVING MIAMI BY PLANE TUESDAY FOR CRISTOBAL CZ WHERE ILL BE BASED AT PRESENT=

A Pan-American-Grace Airways Plane flying over the Andes in South America

INTERESTING FACTS ABOUT PARKS AIR COLLEGE

Founded by its President, Oliver L. Parks, August 1, 1927. Owns its own airport of 100 acres.

Has 14 buildings with a total floor area of 119,352 square feet (2¾ acres) all devoted to school purposes.

3 dormitories and a dining hall on the field are operated for Parks students.

10 training planes on the flight line ranging from the Kinner Sportster up to a new low-wing, bi-motor plane equipped with retractable landing gear, air brakes, two-way radio and blind flight instruments.

Offers three 2-year courses (96 weeks) leading to Bachelor of Science degrees in professional piloting; Aeronautical Engineering; Aviation Mechanics.

Also offers 8 partial courses and combinations of courses which require from 36 weeks to 152 weeks for completion.

Faculty of 26 is composed of specialists in various fields of aviation.

A total personnel of 51 people.

Enrollment of 243 of which 225 are registered in two-year courses, at the beginning of the Spring term.

1306 graduates.

53,248 hours of student flight instruction.

Graduates with every leading aeronautical concern in America and in many foreign countries.

This graduate* completed the Executive Transport Pilots' Course at Parks Air College. He applied for a position with Pan American-Grace Airways, and went to New York for an interview with Company officials.

As the telegram indicates, his application was accepted and the company arranged transportation to his first base in the Canal Zone. Since that time, eight months ago, he has been engaged in flight operations up and down the west coast of South America and occasionally inland "to La Paz, Bolivia, which," he wrote, "is upstairs, the field being 13,000 feet above sea level."

Another graduate* completed the Master Mechanics' Flight Course a little over a year ago. He has since been in the Maintenance Department of Pan American Airways. He writes that recently he was transferred to a new base, given an excellent promotion and a substantial increase in salary.

These are but two of the 137 graduates that could be mentioned who have entered the industry in the past 18 months. It is significant that the majority of them, 63 per cent, are in air transport. Requirements in air transport are exacting. Only men of high calibre who are thoroughly efficient and dependable can be considered. Parks graduates fulfill these requirements. That is why they are in demand for air line service.

A few days before this was written an air transport official* used the long-distance phone to ask President Parks for 21 more graduates. Similar requests are received frequently. In fact, the requests have been exceeding the number of graduates 2.8 to 1.

The reason is evident. Officials of four major airlines . . . airlines which flew 13 1/3 million **more** passenger-miles in 1935 than all other airlines of the United States together . . . have helped build Parks courses. Their experience in operating 50,000 miles of airline routes in both hemispheres, in three continents and across the Pacific, has gone into Parks training. It is but natural they should want Parks graduates for they know they have been properly trained.

After you secure Parks training there will be requests for your services, too. With Parks training you can make an excellent connection and then win promotions. You can make a career for yourself in commercial aviation.

More than one thousand Parks graduates started their careers in aviation by first sending for the Parks Air College catalog. You can start yours the same way now.

Fill in and mail the coupon below and the catalog containing 146 photographs, all taken at Parks Air College, will be sent to you. You will find it interesting, packed full of valuable information and it will cost you nothing. Send the coupon now. Then you'll be sure of getting your copy of the catalog.

Fall term starts September 28th

*Name on request

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

Accredited by the Illinois Superintendent of Public Instruction.

Ask anyone in aviation about Parks. Pay us a visit. You can expect more and still be agreeably surprised when you come.

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SECTION 7 AD

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Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name__________ Age_____
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CHECK HERE
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- ☐ Executive Transport Pilots'
- ☐ Aeronautical Engineering
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In **SOUTH AMERICA** . . . on Pan American Grace Airways.

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In **AUSTRALIA** . . . Holyman's Airways.

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Texas Centennial Exposition now open. Greatest national world's fair in the U. S. See this big show while taking your course.

Part time work with every course if desired.

10 Years of Success

in the operation of this school under the same management. We have no financial obligations and own the school plant (14 buildings) and all ground and air equipment free of debt. We have built our school on a business basis.

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our ships, school plant and equipment with any in the Nation. Check item by item and you will readily agree that we have more training for you for less money than elsewhere. You be the judge.

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260 H.P. Wright motor—equipped for night, blind and radio beam flying. Fine cross country ship. You'll like it.

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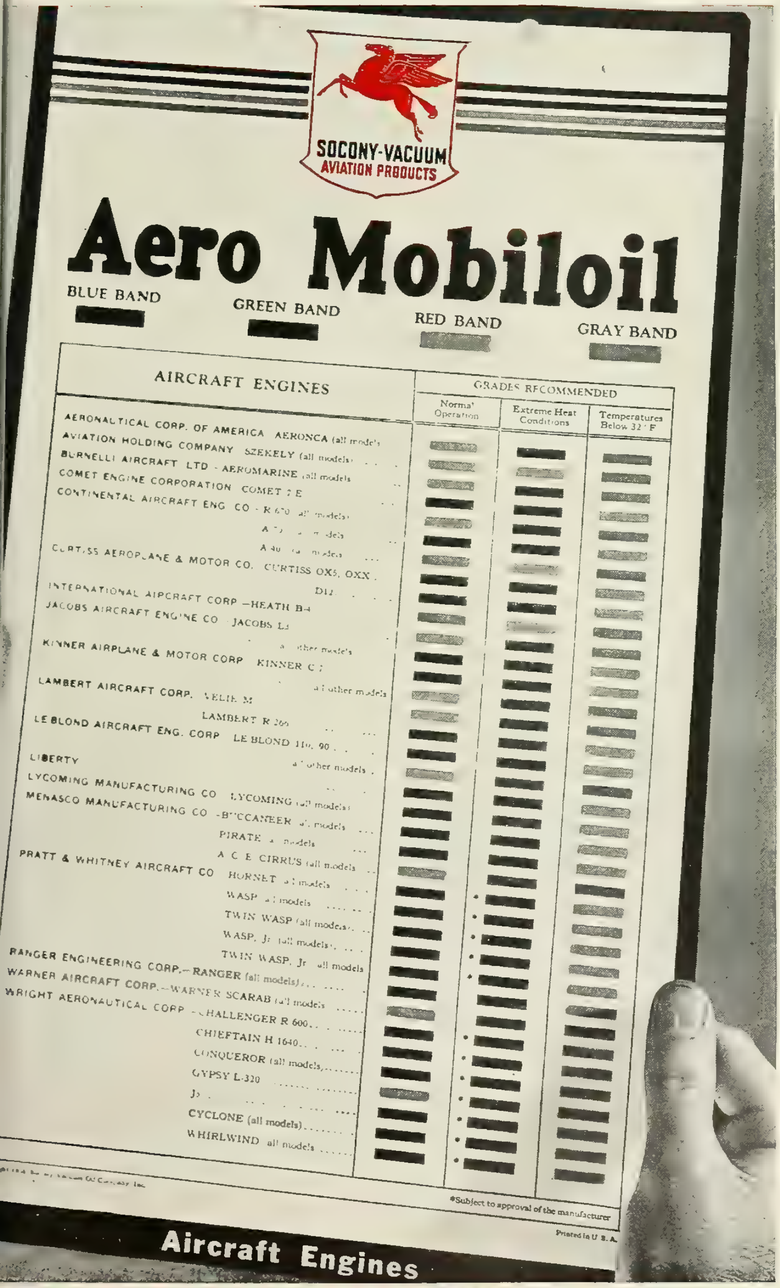
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The new Aero Mobiloil "Gray Band" is recommended for small airplanes equipped with low-horsepower engines—and for larger engines under unusually cold conditions. Aero Mobiloil "Gray Band" meets the requirements of all leading light engine manufacturers—and those of the U. S. Army and the U. S. Navy. It is worthy of your confidence.

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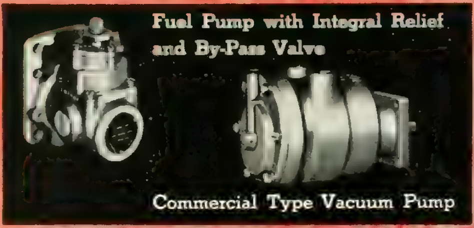
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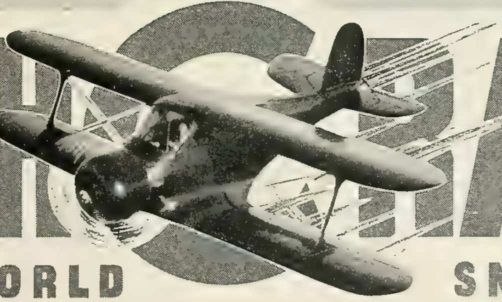

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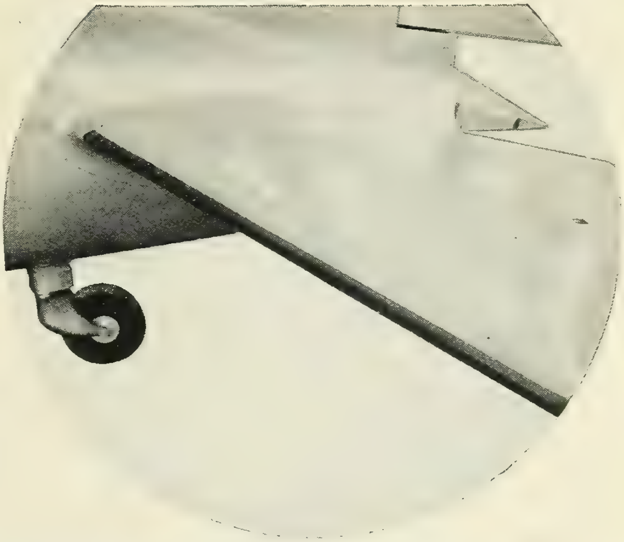

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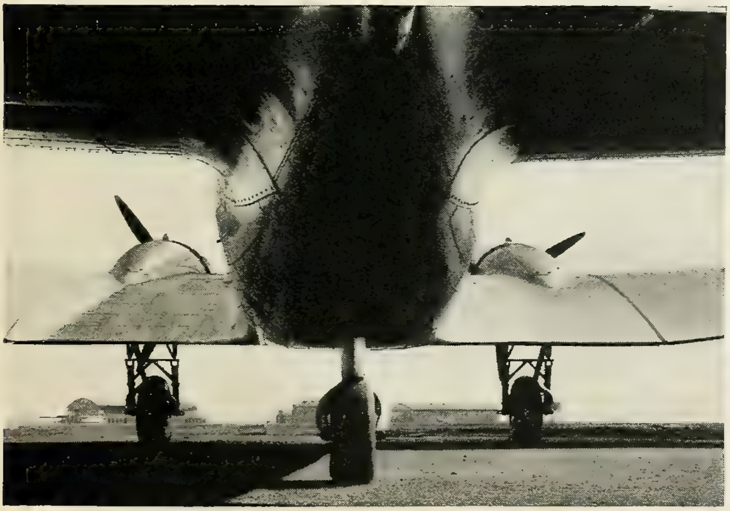

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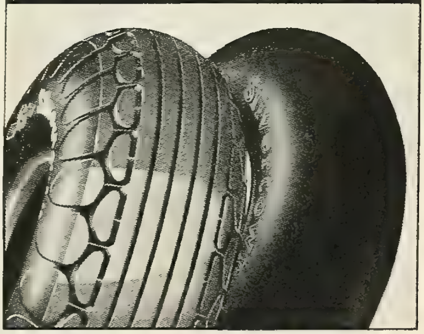

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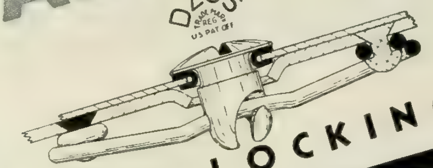

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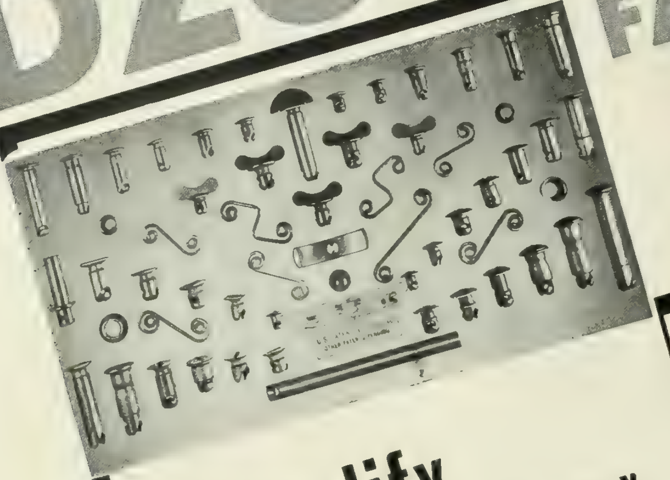

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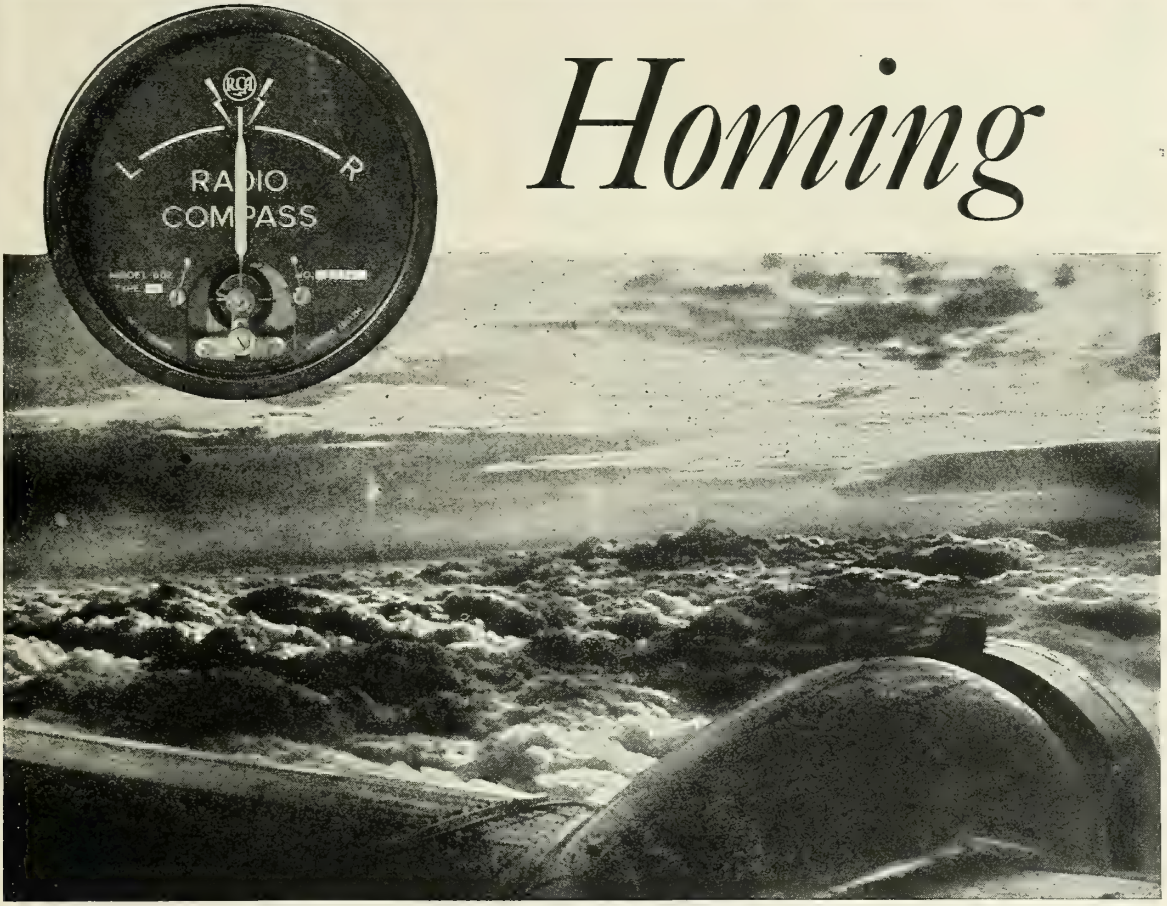

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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone PLaza 3-6969. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5. Copyright 1936 by Aeronautical Digest Publishing Corporation.

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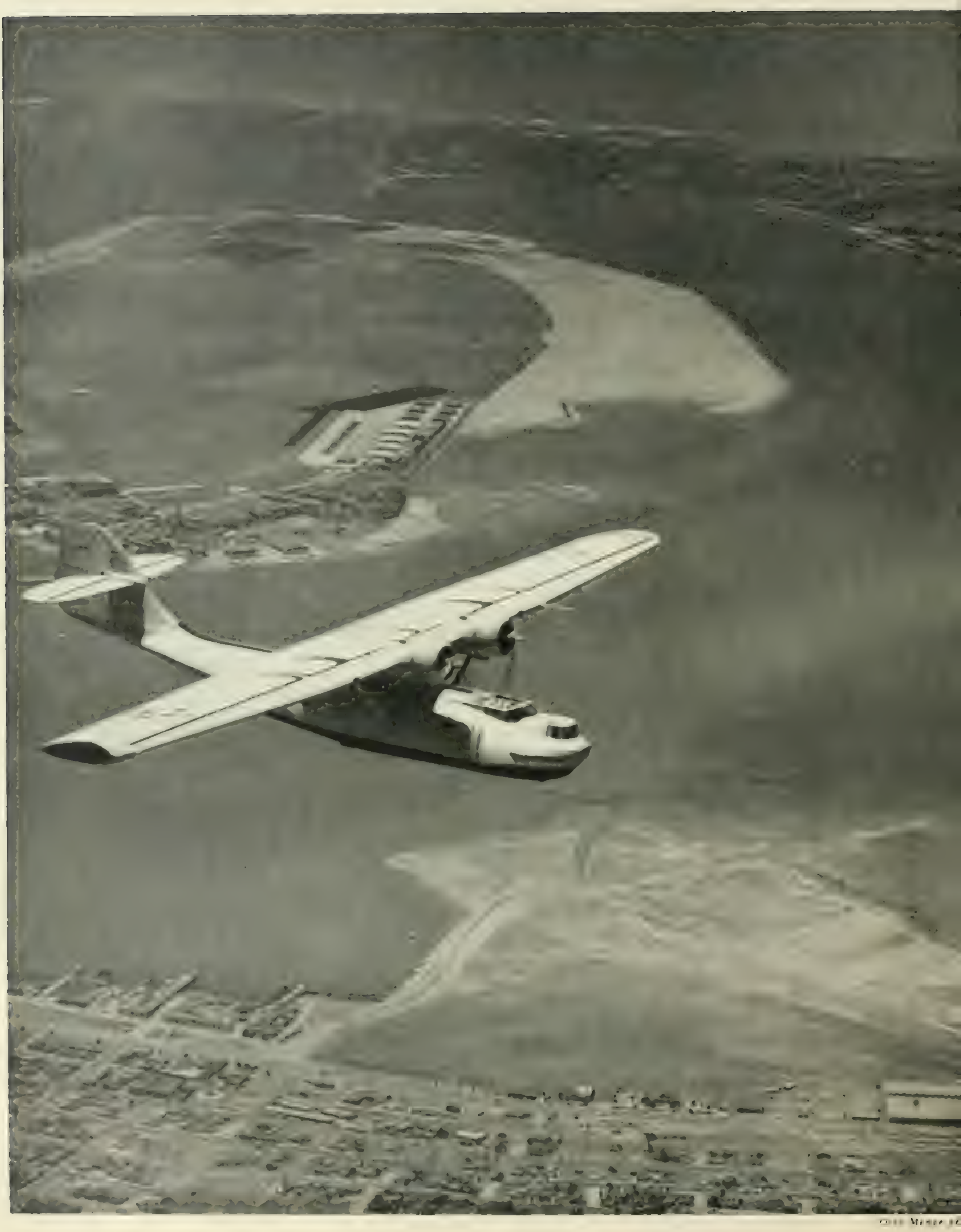

One of the latest twin-engined Pratt & Whitney powered Consolidated PBY-1 Patrol Flying Boats. In the foreground is Lindbergh Field, San Diego, at the right of which is seen part of the new Consolidated factory where sixty of these long range patrol boats are under construction for the United States Navy

PRESERVE OUR AIR RESERVE

●

CY CALDWELL

● There are about 1,340 Regular officers in the U. S. Army Air Corps, but in the event of war we could place in the field as pilots of combat planes no more than 500 of them. The area of the United States and outlying possessions is about 4,000,000 square miles; the population is about 150,000,000. You don't need a slide rule to figure out that we have only one Regular Army pilot to defend each 300,000 of our population and each 8,000 square miles of territory. Truly, the More Abundant Life has not yet reached the Air Corps.

Although the Air Corps Act of 1926 authorized a total establishment of 1,650 officers, the Air Corps has averaged less than 1,300 officers for the past ten years. It has been 350 officers under strength in that period. During the same period the Coast Artillery and the Cavalry have been over strength—yet the Coast Artillery has never fired a shot from our coasts in any war, and the Cavalry saw no service as Cavalry in the war of 1917-'18—I believe some of the Cavalry were dismounted and served as machine gun units. Both of these moribund services are adequately represented on the General Staff; the Air Corps is not. That may be the answer.

As of Dec. 31, 1935, the status of Regular and Reserve officers and Flying Cadets was as follows—and the figures are about the same to-day: There are 1,343 Regular officers, 189 Reserve officers on extended active duty, and 135 Flying Cadets who have completed flight training and are on one year's flying duty with tactical units.

While the Air Corps now gets 50 officers a year, this number is little more than enough to take care of replacements due to retirement or physical disability for flying, or other wastage, such as crashes. Before the House Military Affairs Committee in March, Captain Elmer C. Adler testified that by the end of the 1937 calendar year we will have airplanes and not enough pilots to fly them unless we build up the flying personnel. But the March class entering Randolph Field for training numbered only 50 men, instead of the 150 desired, and this number completely exhausted the Army's eligible list. As a rule only 55% of those entering finally are graduated as pilots.

Now it is a common delusion that in the event of war all officers in the Regular Army, with the possible exception of the Generals, will dash into the fray and fight might and main for their country. Nothing, however, could be further from the truth.

Experience has demonstrated that modern large-scale wars must be fought by civilians, trained and directed by Regulars and by Reserves. There simply are not enough Regulars to run a war for six months. In that period the Regular forces of both combatants would be obliterated. Hence it is the policy to build up trained and partly trained Reserves which we can throw into the breach until the Civilian Army, which really is going to do the bulk of the fighting, can be formed and trained.

Analyzing the List

Let us analyze the list of 1,343 Regular officers and see how this number will automatically be whittled down to only 500 combat pilots. There are three classes of rated officers who are flying as Observers, not as pilots. There are 35 who have airship pilot ratings who are flying now as Observers, due to there being no airships available for them. There are 44 heavier-than-air pilots flying as Observers, due to physical disqualification as pilots. There are 6 airship pilots flying as Observers, due to physical disqualification for pilot duty; and there are 10 officers who hold Observer ratings only. This makes a total of 95 Regular officers who are flying as Observers. In addition, there are 8 Regular officers who hold no flying rating of any kind but are assigned to duty involving flying—such as medical officers. And there is one officer assigned to the Air Corps who holds no flying rating and is not assigned to flying duty. Thus there are only 1,239 Regular officers flying as pilots.

There are 2 Major Generals and 6 Brigadier Generals. We may begin by writing off the Generals as fighting pilots; for all of them, while they fly on occasion, are engaged in important executive work, 99% of which is performed on the ground. We may also write off as war pilots the 22 Colonels and 69 Lieut. Colonels for, like the Generals, these high ranking executive officers must spend their time on the ground directing their forces. Experience has showed that Generals die in bed and, on the whole, Colonels—many of them as Brigadiers, for war promotion is rapid.

This rapid promotion in time of war must remove from the fighting list many of the 248 Majors, not all of whom are active pilots now. They will become Lieut. Colonels and Colonels, and spend most of the war on the ground directing those of the 575 Captains, the 338 1st. Lieuts., and the 100 odd 2nd. Lieuts. who are not assigned to other than combat duties. In war, Lieuts. and 2nd. Lieuts. are considered as expendable material. Captains may be used up when needed, and in emergencies even Majors may be wiped out. But on the average, it takes 16,987 tons of high explosive to kill anything higher than a Lieut. Colonel. The cost of bagging a General is absolutely prohibitive, and in the last war no pelts were collected by either side.

Major General Oscar Westover, Chief of the Air Corps, tells me that the objective toward which they are working at present is to have practically all the officers of all grades who are assigned to the GHQ Air Force qualified for active duty as pilots, and capable of taking the field as such in an emergency. There are now only 6 or 8 officers in the GHQ Air Force who are not flying as pilots. And the General states that under present plans all the GHQ officers would take the field immediately upon the occurrence of a major emergency. This plan shows a commendable spirit in our senior officers.

It is extremely desirable that all officers, including Reserve officers of high rank, should be pilots, if physically qualified. And on occasion they should actually lead their forces in air fighting, not only to familiarize themselves with actual fighting, but also to strengthen the morale of the forces under their command.

But to follow this procedure every day and every week is practically to guarantee the eventual loss of these officers whose long experience and ripe judgment cannot be duplicated immediately by the younger officers promoted to their places—though the removal of certain officers, by any means, might be a distinct gain for the Air Corps, leaving the way to advancement open to more capable younger officers. But in general the replacement of experience by the mere enthusiasm of youth could not be counted a gain. Such a plan runs counter to every precept of war: to conserve experience and brains and expend inexperience and animal courage. That's why we keep our Generals back of the lines, out of range of anything but aerial bombs.

So far, we have considered only those Regular officers whose rank may, and I think probably will, remove them from that intimate contact with bombs and bullets which makes war so stimulating to the lowly Lieutenant. Other than combat duties must absorb the services of a large number of flying officers. There are the important requisites of training, procurement, and supply that will necessitate detailing several hundred officers to that work. It is a reasonable estimate that for every Air Corps officer detailed to a fighting unit there are two or more officers detailed to duties other than combat. At the beginning of the present year there were only 442 pilots of the Regular Air Corps assigned to duty as pilots of combat squadrons located in continental United States. The remainder were assigned to other indispensable duties.

Increase in Duties

Immediately upon the outbreak of war those duties would increase many fold. Training alone would absorb three times the present number of Regulars. Aircraft, engine, accessory, and supply procurement, including testing, would demand far more than double the number of officers presently assigned to that work. It is not generally known to the public, but it is a fact that a highly technical service such as the Air Arm may require at the start of a war the services of four officers in duty other than fighting, for every Regular officer actually flying a combat plane. General Westover believes that in a major war of considerable duration, that of the officers assigned to the Air Corps at the end of the first year, not to exceed 20% would be pilots of combat planes. Perhaps another 25% would be serving in the theatre of operations and be designated as officers of the combat service. The rest probably would be serving in the Zone of the Interior, and therefore not in the immediate presence of the enemy.

Without presuming to assign any definite number of officers to these duties, I have estimated that the Air Corps would be unable to place more than 500 Regular officers in the air as pilots of combat planes. Without endorsing that number, General Westover says that it is approximately correct. So as we have 4 million square miles of territory and about 150 million people who will clamor for air defense in time of war, it is obvious that our devoted little band of 500 Regular officers is going to need help. Few of our citizens (and not many even in aviation) know that the actual fighting end of our Air Corps is so small. It cannot become any larger under present laws and under the amount of money available for the Air Arm.

Of course wars are fought by civilians; the Regulars tell them how to fight. At the finish of the last war we had 11,000 flying officers and 9,000 semi-flying officers, and not much over a couple of thousand DHs. It is clear that we cannot maintain in peace times enough fighting pilots to wage war unassisted by some of the rest of us—preferably the young man just out of college, full of enthusiasm and the illusion that war is a lot of glorious adventure. The late William Jennings Bryan, I believe, said that if America is attacked, a million men would spring to arms—neglecting to add that you can't spring to arms that aren't in existence, and that even if they existed you still must learn how to use them. At present there are not enough modern airplanes for even the 500 Regular officers of the Air Corps to leap into; and even if the planes for them existed, the civilians would require months of training before they could fly them and fight effectively. Meanwhile someone must do the fighting, or some of the fighting, if there's anything to fight in, lest we use up all of our Regulars before they have trained the more simple-minded civilians. This is where the Air Corps Reserve comes in.

Now, the Air Corps Reserves are sort of Lost Souls, wandering in a No Man's Land that lies somewhere between Army life and civilian life—another group of Forgotten Men. About 15% of these Reserve officers get two weeks' active duty with pay once a year (but not every year) and they may come out to designated Army fields (at their own expense) and fly (on their own time and with no pay) during the year. If they are crashed and killed during a training flight they are a total loss to their families, for the War Department provides them no insurance. They are patriots and are supposed to fly, and if chance so directs, to die for nothing. They are admirable citizens, if anyone would pause long enough to admire them. But few do.

1600 Graduates

The most valuable fighting element of the Reserves is the group of about 1,600 young men who are graduates of the Air Corps Training Center in recent years. These fine, new pilots could be made ready for tactical units at the front in a relatively short time—as I mentioned before, 189 are now on one year's extended active duty. There are some 200 or 300 older Air Reserve officers, in addition to airline pilots, who have kept up their active flying by the use of private airplanes, in part, and by taking the 48 hours' flying per year authorized by Army regulations. The Air Corps keeps accurate record of these officers and is endeavoring to keep their mobilization assignment such that they will be utilized to the best advantage in a war emergency.

The status of these officers has not been an especially happy one, although they have endured it with little complaint. They haven't had enough flying in service ships to keep them in training. This year they will be given 100 hours, if they care to take it. But many live far from Army stations, and can afford neither the time from their civilian jobs nor the traveling expenses. Many of them have families and they feel, reasonably enough, I think, that if they undertake air training for the country's protection that they at least should be given hospitalization in the event of injury; and that their families should receive compensation in the event of their death while on duty.

A Ray of Hope

Under a bill introduced in the House by the Honorable John J. McSwain, Chairman of the House Military Affairs Committee, the Reserves may at last get their due—and it is little enough that they ask. This bill (H.R. 12241) provides for training and pay for authorized training flights at the rate of a day's pay and flying pay for each day of authorized flight training, not exceeding four in any month and 30 in the fiscal year. It also provides for the same pay, hospitalization, or other benefits allowed personne of the Regular Air Corps; and the same Regular Air Corps death benefits for the dependents of Reserve officers who may be killed in practice flights.

I hope that President Roosevelt wil put H.R. 12241 on his "Must" legislation so that the More Abundant Life may be made available for the dependents of Reserve officers. It might even be made retroactive and thus enable belated justice to be done to the dependents of those Reserve officers killed during the Roosevelt Farley Army air mail experiments. (By the way, we are still awaiting the publication of Colonel Ristine's report on the air mail cancellations. We may have to wait until the Republicans get in again before we learn the truth of that matter.)

Another matter that has saddened the lives of our Air Corps Reserve officers is the type of equipment they have been forced to fly. They flit forlornly about in such vintage craft as O-25, O1-E, PT-3 and P-6. These are ancient Observation Primary Training, and Pursuit ships, al of them around six years old. Compared to automobiles of like age, they are Mode A Fords of the air; not V8s. Some are even as old as the last issue of Henry' famous Model Ts.

In passing, I might mention that a the Air Corps Tactical School, where the very latest didoes in air fighting are taught, there is not a single really moder combat plane! The tactics, therefore, are all theoretical—terrific paper air wars ar worked out, in which P-12s, P-26s, and even perhaps P-6s emerge victorious ove modern bombers—maybe. The pursui tactics, for instance, are based entirely on pursuit ships that now are only in th design stage. There is not even any us in figuring out tactics for obsolete pursui ships, because they couldn't catch any thing faster than a Keystone Bomber.

The fault for this condition lies somewhere between the War Department and Congress, and it would take a mathematician and an astrologer to discover where the fault actually lies. But the sad fact is that any discussion of Air Corps matters, in the Regulars or the Reserves, finally winds up, stuck fast in that awful bottle-neck known as Shortage of Equipment. A plan has been suggested whereby some of the Reserves would be assigned to local Defense Squadrons to be equipped with pursuit ships. But this plan sticks in the bottle-neck—there are no modern pursuits even for the Regulars; and by the time P-26s could be made available for the Reserves they would be hopelessly out of date for anything but training, and what we might call elementary pursuit training, at that.

Meanwhile, Congress has seen the error of its ways, to some extent, and funds have been voted partially to make up for this shortage of equipment during the next few years. Even the long-suffering Reserves have not been forgotten. They are getting 7 brand new Douglas 0-46A with Pratt & Whitney Twin Wasp Jr. engines, and 40 BT-9s from North American Aviation. So they are on the road to better times—and high time, too.

The Master Minds of the General Staff and the Air Corps are fully awake to the fact that the Regular Air Corps is going to need a lot of help in a war emergency, and they are doing their best to insure that at least partially adequate training is given to the Reserves, especially to the younger officers who would be fit for active combat duty. They have realized that the younger Reserve officers are losing interest in a defense system which unreasonably expects them to train for nothing and die on the identical basis, leaving their families unprotected. Unless the McSwain bill passes, still more Reserve officers will fade right out of the picture.

Experienced Old-Timers

Meanwhile, there is a group of older Reserve officers in which the Air Corps itself seems to have lost interest—those officers of the war years, now considered too old for combat. But these are the very men who have kept alive interest in Reserve matters; these are the experienced old-timers who will be invaluable in the next war, not as pursuit pilots, but as executive officers not only in the Zone of the Interior, on supply, procurement, and training, but also in the theatre of war, in other than purely flying duties. These are the officers who know what it's all about; these are the men whose experience and seasoned knowledge cannot be duplicated by younger officers.

One error into which the Regular Air Corps falls, it seems to me, is in saying, in effect, "We haven't enough airplanes even for the Regular Air Corps, let alone the Reserves. So there's no use in training more pilots than we can find airplanes for. By the time we can build planes for a major war, in the same time we can train young college boys to be pilots." Quite so. But in that brief period we cannot duplicate the ability, the knowledge, the experience of these older officers who will be urgently needed in administrative work. That they should be active pilots is desirable, but not necessary; there are a thousand and one jobs for technical officers. You may train a war pilot in a year; it takes years to make a good technical officer.

Through shabby, penny-pinching policies we have been driving both our younger and our older Reserve officers away from the service. Only the reversal of those policies will give the Air Reserves a square deal.

Editor's Note: The status of Air Corps Reserve Officers discussed herein is not affected by the recent passage of H.R. 11920, authorizing the President to call up to 1,350 Reserve Air Officers for a five year period of active duty.

AIR
HOT AND OTHERWISE

Ten Long Years!

FRANK A. TICHENOR

● For ten long, long years AERO DIGEST editorially has endeavored to arouse the aviation public to the necessity of an organization able to carry on the fights, legislative and otherwise, for the industry in Washington, and in August, 1926 there appeared in these columns the following:

"This is a call to those whose interest in aviation is such that they honestly want to see it prosper in its commercial activities and ranking at the head of our national defense system, where it rightfully belongs." . . .

"The influence upon the members of the Senate and the House of a civilian organization, if we had one which was truly representative of the population and honestly interested in American aviation, would be paramount. Such an organization's influence would overcome the prejudiced, unfair and unreliable evidence foisted upon Congress by those of the Army and Navy who realize that as soon as general knowledge of the facts regarding the place the air force should have in our national defense inevitably must mean 'this way out' for them.

"The National Aeronautic Association should have been ready, without asking, to furnish the preponderance of important testimony at all investigations and should have had as its leader an executive actuated by those patriotic, unselfish motives which would have made his words impressive.

"The desire, honest and earnest, of the members of the Senate and House to get authentic information of a sort competent to guide them in the formulation of intelligent legislation to help commercial flying in America, and to secure evidence to offset the asinine claims made by the bureaucrats of the Army and Navy as to the value of aircraft, always has been evident." . . .

"The present membership of the National Aeronautic Association is about 5,000, of whom approximately 2,000 are members of one chapter, and 20 are Junior members. The National Geographic Association has over 112,000 members in New York State. Surely the national defense and economic welfare of the United States is as important as its geographical education.

"The National Aeronautic Association should have at least one million members and twice as many Juniors. If in the five years of its existence, its leaders had devoted the same amount of time and energy to securing Junior members that they have devoted to playing petty politics among themselves, if they had taken into the Junior organization all the right sort of boys and girls of say sixteen years that they could get, these youngsters would be senior members now, and as voters would be able to put over any legislation necessary to protect and encourage the rapid expansion of the industry.

"With the proper leader and a worthwhile program there would be no occasion for the independent clubs which now, for perfectly good reasons, ignore the National Aeronautic Association, and when this leader and program are secured these independent clubs will soon become associated with it.

"If aviation is to come into its own in the United States it is necessary that there should be behind it a really, big, well-organized civilian organization. This must have as its officers those not soliciting political appointments or social prestige for favorites, but men who are willing to fight its battles without regard to the position they hold or may hope to obtain. There are such men. They must be found, and if not found by the National Aeronautic Association, a new organization will find them, and then all that will be left for the National Aeronautic Association will be the last sad rites and interment at 2 p.m. on Friday, the 13th, send no flowers.

Re-born Organization Needed

"We need a re-born National Aeronautic Association. Fresh blood, active brains and the elimination of all flunkyism and favoritism for those who wear gold lace on the part of its Washington representatives is needed."

And we further quote from the September, 1926 issue.

"As I write the delegates are gathering in Philadelphia for what, if they so decide, may be made the greatest constructive effort ever made in the United States toward the furtherance of aeronautics. If they determine otherwise this effort may become the most destructive. It is for the delegates to choose; therefore on their determination hangs the fate of American aeronautics for the time.

"This being the case AERO DIGEST's suggestion to the air-minded of the country is a season of prayer that those delegates when they begin to work may select as President and other officers of the organization men of experience, vision, practical common-sense and unselfish enthusiasm, untainted by fads, foibles or toadyism, and choose as an Executive Committee men who will outline for the body such a comprehensive program as will combine all those interested in aeronautics into a real national effort.

"If this is done when the next convention comes together in 1927, whether on the Pacific Coast, the borders of the Gulf of Mexico, or at the North Pole, the accomplishments of this year and the plans formulated will have so stirred general interest during the intervening twelve months that everyone will want to be there.

"Replies to a questionnaire sent out by this publication to members of the various chapters have brought replies indicating that many of these bodies propose to send no delegates to the convention. This is tragic. But the reason is succinctly stated by the query, 'What's the use?' And who can blame them?

"That such indifference or distrust should be a general mental attitude is one of the saddest things imaginable and auguring very ill for the future of that art and industry which now comes nearer than any others to being of paramount influence upon the future of the nation.

"There can be but one deduction and that is that the N.A.A. as at present constituted will not do. Left alone it will vanish from the surface of the earth, as from the airways high and low which are above the earth. It must be revamped to meet the new conditions which have come into being since its birth." . . .

And in February, 1936 Cy Caldwell wrote:

"The industry has been fooled many times before by these spasmodic spurts of the NAA. Many times before money has been donated by the industry and by private individuals to further the cause of aviation. . . . In a few months' time the NAA will demonstrate whether it is really going places, or whether like the music in the popular song, it will continue to go 'round and around—woe-owe-ho-ho-o-o-o-o!"

It is now six months since the election of its president, and in August we intend to report to you on its activities during this period. We still maintain that under proper leadership the aviation industry can enroll one million voters back of it. With this force there will not be a repetition of the Roosevelt-Farley air mail fiasco, the Black investigation and the thousand-odd (very odd) other legislative hindrances to the industry.

EDITORIALS

> "We must drive home to the public consciousness the fact that non-scheduled flying in modern licensed airplanes, with licensed pilots, in conformity with Bureau regulations is not the dangerous undertaking popularly supposed. If we are successful, we can claim a major contribution to aviation and safety in general."—WILLIAM W. BRINCKERHOFF, President, Private Fliers Association.

Assistance from Allied Industries

● With the publication of our Second Annual Digest of Aircraft & Engine Materials, we once again are reminded of the importance of those industries that supply us with the raw materials and fabricated parts that go into our aircraft and aircraft engines.

Awakening of these allied industries to the ever-increasing influence of the airplane, has enabled the aircraft industry to attain greater safety in the air.

Devoting more experimentation and research to produce materials suitable for aircraft has had far-reaching influences, even outside of the aircraft industry. In this regard, we find the new aluminum-alloy streamlined trains and the aerodynamically-shaped modern automobile as outgrowths of aeronautical research.

For lining airplane cabins, affording a neat interior trim and providing excellent insulation against sound and outside temperatures, one company has recently developed a pyroxylin-coated felt 3/16 inch thick having a facing similar to artificial leather. It is supplied in 54, 60 and 66 inch widths, in a number of different grains and finishes. Another company is producing light weight compact sound-deadening felt which is flame-proof. For companies using real leather in their upholstering, a newly-developed light-weight leather is available having a special finish which withstands any normal temperature without being sticky in heat or cracking in severe cold.

New methods of fabrication are being evolved, and new products developed at a pace commensurate with the rapid growth of our industry. With the assistance of our allied industries, the aeronautical industry will not only be successful in achieving its own healthy growth, but will also reflect credit and assistance to those individual allied enterprises which have participated in this growth.

For Air Express Service Exclusively

● When express was first carried by air, prognosticators spoke of the day when airplanes would be specially designed for this work.

Through the intervening years, however, express poundage hardly justified the move. But unification of air express services and greater endeavors to attract more business, brought increases in poundage which crowded payloads to and beyond capacity, and accelerated the debut of the "all-express" airplane.

TWA, for instance, is now conducting a series of test flights and surveys on a "flying express car" to meet demands of its customers, including more than 500 new ones each month. Costs and operating conditions are being investigated. One Douglas DC-2 has been converted into an express carrier, and the possibility of using a single-engined plane is also being studied.

With express poundage growing steadily and keeping pace with expanding passenger business, the day of the express plane is at hand. When such a plane is built the 5-million-express-pounds-per-year goal of the American airline companies will be nearer attainment.

Non-Political Aviation Associations

● The aviation associations springing up throughout the country indicate a sincere desire to help the industry grow and expand normally.

Much good can be expected from a united group campaigning for the elimination of artificial and needless restrictions that would unnecessarily retard progress. Even greater results would naturally ensue if, when petitioning legislative bodies, no political axe is ground or personal gain anticipated. Political motives such as these have no place, either in national affairs or purely local groups. Unfortunately at present, it is difficult to control politicians planted in government office either by unthinking voters, or installed in a swivel chair by unscrupulous politicians for "services rendered."

Our state aviation associations, however, can be and should be conducted for the welfare of the industry as a whole. Executive committees and officers should not be chosen for the possible political pressure they might bring to bear, but for their zealousness and constructive efforts to get the greatest good for all rather than personal glory for a few.

Now is the time to anticipate the power which these associations can wield if they begin on a non-political basis and make every effort to prevent politics from creeping in and destroying their effectiveness.

Scientific Research?

● The difference between scientists and garden variety inventors is that in seeking to solve a problem the latter try everything occurring to them, while the former, armed with knowledge of the art and the weapons of analysis, select from innumerable possible approaches those most promising and least wasteful. The scientist arrives at a solution having previously calculated the results he expects to obtain.

In NACA Technical Report N552 on autogiro blades tested by the authors, we learn that better results would have been obtained were the blades properly tapered and twisted and had the blade area not been removed at the root. Since gyro blade operation is one phase of propeller cycle operation in its broader aspect, mathematical analysis of the problem would have given this answer without the waste of time necessary by the elementary cut and try approach apparently selected by our main research body.

Let us have more serious scientific research in justification of the expensive plant, equipment and personnel comprising the National Advisory Committee for Aeronautics.

Preservation of Historical Relics

● Until recent years little thought has been given to the preservation of relics of the industry, trophies and early records of airmen who played such a vital part in the development of aviation.

Through the practical interest of Henry and Edsel Ford, however, announcement was made last month of a suitable place to safely preserve for posterity the records, photographs, biographies, antiques and other irreplaceable material of historical interest of the *Early Birds,* whose members are among aviation's first students and inventors. Many of their earliest planes, engines and other handiwork are still in existence. It is most fitting that they be housed in such a permanent home as offered by the Edison Institute Museum in Dearborn, Michigan, which together with Greenfield Village is dedicated to the preservation of science, industry and home life of America's great pioneers.

Again the Fords have shown their unselfish interest in the pioneers of aviation.

AVIATION ENGINEERING

DR. ALEXANDER KLEMIN • GLENN D. ANGLE • DR. MAX M. MUNK • DR. MICHAEL WATTER

An Analysis of the INFLUENCE OF DRAG ON SPEED of Modern Transport Airplanes

FRED S. CHAMBERLIN

First Alternate, Boeing School of Aeronautics Scholarship Competition

● Drag characteristics of an airplane are the major items in determining high speed and it is the purpose of this paper to analyze the effect of further improvement in these characteristics on the speed of future transports.

Drag may be divided into wing drag and parasite drag. Wing drag may be further subdivided into induced drag, form drag, and skin friction. Parasite drag (which is that caused by all elements not contributing to lift) is composed only of skin friction and form drag. The drag distribution in a typical modern transport can be shown by a sample calculation, and the Boeing 247-D will be used in this example. This transport has a wing area of 836.3 ft.², a gross weight of 13,650 lbs., 1100 hp, a maximum speed of 200 mph at 8000 ft., and a landing speed of 62 mph at sea level.

Determination of Total Drag (8000 ft.)

Propeller efficiency:

Using a 10 ft., 3-bladed, controllable pitch propeller on 550 hp Wasp engines, geared 3:2.

$$V/ND = \frac{200 \times 88}{2200 \times 2/3 \times 10} = 1.2$$

$$C_s = \frac{0.638 \times 200}{\left(\frac{0.70 \times 550}{0.7859}\right)^{1/5} \left(2200 \cdot \frac{2}{3}\right)^{2/5}} = 1.99$$

From NACA working chart (1), blade angle, B, for V/ND of 1.2 and C_s of 1.99 is 32°. For B of 32° and C_s of 1.99, efficiency, n, is 87.4%.

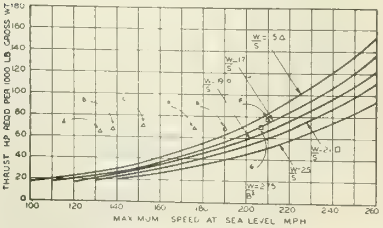

Fig. 1. Curve of speed against thrust hp for a perfectly streamlined airplane

This efficiency is not excessive as the V/ND is high and no compromise is necessary for take-off or climb conditions.

Total drag:

$$\text{Drag} = \frac{\text{B. hp.} \times n \times 375}{\text{MPH}}$$

$$D = \frac{1100 \times 0.874 \times 375}{200} = 1801 \text{ lbs.}$$

Determination of Component Drags

Wing drag:

From data furnished by the Boeing Airplane Company, the total wing drag coefficient (NACA) for the 247-D is calculated to be 0.01177 at the high speed angle of attack.

$$\text{Wing drag} = C_D \frac{p}{2} S\, V^2$$

where

S = wing area
p = mass density of air
V = velocity in ft./sec.

$$D_w = 0.01177 \times \frac{0.001867}{2} \times 836.3 \times (200 \times 1.467)^2 = 786.5 \text{ lbs.}$$

1. Induced drag (assuming semi-elliptic loading):

$$\text{induced drag} = \frac{L^2}{\pi \times \frac{p}{2} \times b^2 \times V^2}$$

where

L = lift weight
b = span

$$D_i = \frac{13{,}650}{3.14 \times \frac{0.001867}{2} \times (74)^2} \times \frac{1}{(200 \times 1.467)^2} = 134.5 \text{ lbs.}$$

2. Profile drag:

Profile drag = $D_w - D_i$

$$D_o = 786.5 - 134.5 = 652 \text{ lbs.}$$

a. Skin friction:
[Gottingen Interpolation Formula (2)]

$$C_Df = \frac{0.455 - 1700}{(\log R.N.)^{2.58} \quad R.N.}$$

where

C_Df = skin friction coefficient
R.N. = Reynold's Number (17.6×10^6 for 247-D).

$$C_Df = \frac{0.455 - 1700}{(\log [17.6 \times 10.^6])^{2.58} \; (17.6 \times 10^6)}$$

= 0.00263 for total area
= 0.00526 for normal area

Skin friction, D_s, =

$$0.00526 \times \frac{0.001867}{2} \times 836.3 \times (200 \times 1.467)^2 = 353.5 \text{ lbs.}$$

b. Form drag (includes wing-fuselage interference):

Form drag = $D_o - D_s$

$D_{Fo} = 652 - 353.5 = 298.5$

Parasite drag:

1. Engine nacelles:

From Boeing data the C_d referred to wing area is calculated to be 0.002675 (includes wing-nacelle interference).

Engine nacelle drag

$$D_n = 2 \times 0.002675 \times \frac{0.001867/2}{2} \times 836.3 \times (200 \times 1.467)^2 = 358.3 \text{ lbs.}$$

2. Tail surfaces:

C_d referred to wing area is 0.00292.

Tail surface drag

$$D_T = 0.00292 \times \frac{0.001867/2}{2} \times 836.3 \times (200 \times 1.467)^2 = 195.5 \text{ lbs.}$$

3. Fuselage (wheel projections and windshield included):

Fuselage drag

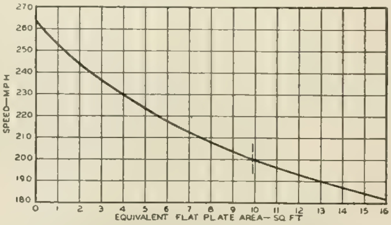

Fig. 2. Effect of parasite drag on high speed of Boeing 247-D at 8000 feet

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1. Weick, Fred E.; *Working Charts for the Selection of Aluminum Alloy Propellers to Operate With Various Aircraft Engines and Bodies.* NACA TR 350.

2. Lyon, M. H.; *The Drag of Streamline Bodies. Aircraft Engineering.* Sept., 1934.

$$D_t = D - D_w - D_n - D_T$$
$$= 1801 - 786.5 - 358.3$$
$$- 195.5 = 460.7 \text{ lbs.}$$

Calculated values are tabulated in Table I. The figures suggest possible procedure for further increasing speed performance of transports.

TABLE I: Component Drags of Boeing 247-D

Part	Drag (lbs.) At 200 mph	Per Cent of Total
Wing:		
Induced drag	134.5	7.47
Skin friction	353.5	19.62
Form drag	298.5	16.59
Parasite:		
Fuselage	460.7	25.57
Engine nacelles	358.3	19.90
Tail surfaces	195.5	10.85

Fineness or general streamline quality is a major consideration, and relative perfection is always obtained by comparison with an ideal. In the case of airplane streamline the ideal is one visualized by Professor Melville Jones of England in *The Streamline Aeroplane* (3). A perfectly streamlined airplane would create a resistance which is the sum of the induced and skin friction drags. There would be no form drag.

Figure 1 presents some curves patterned after those of Prof. Jones but brought up to date in some respects. They represent the thrust hp required per thousand pounds of gross weight for the perfectly streamlined airplane based on modern transport monoplanes.

The thrust horsepower required to overcome skin friction is calculated from the equation:

$$\frac{\text{Th. Hp. Req'd}}{1000 \text{ lbs.}} = \frac{127\, V^3\, \delta}{w}$$

where

V = velocity in hundred mph

δ = relative density of air

w = normal wing loading

This is a derivation of the Gottingen Interpolation Formula

$$C_{Df} = \frac{0.455}{(\log R.N.)^{2.58}} - \frac{1700}{R.N.}$$

using average values of Reynold's Number of 17×10^6 for the wing and 9×10^7 for the fuselage. The ratio of total exposed area to normal wing area used is 3.9, a value correct within 5% for modern transports.

Thrust horsepower required to overcome induced drag is calculated from the equation:

$$\frac{\text{Th. Hp. Req'd}}{1000 \text{ lbs.}} = \frac{3.33\, M}{V\, \delta}$$

where

M = span loading

δ = relative density

V = velocity in hundred mph

Wing and span loadings of several modern transports are in Table II above.

TABLE II

Plane	Wing Loading W/S	Span Loading W/b²
Douglas DC-2	19.02	2.62
Lockheed Electra	21.20	3.21
Boeing 247-D	16.33	2.49
Lockheed Orion	19.72	3.17
Northrop Delta	20.23	3.18

The relatively good streamline of modern transports can be seen from several values plotted in figure 1. These indicate that almost the optimum has been reached, as airfoils and passenger compartments require shapes not of perfect streamline form. One item, however, does show room for improvement. That is the windshield. Wind tunnel tests at New York University (4) revealed that even the best designed windshield increased the drag of an ideal body by between 40% and 60% and although the increase would not be so great for transport fuselage forms it is still excessive.

The use of a retractable windshield is one possibility for eliminating this excessive drag. Such a feature would possibly require indirect vision when in cruising attitude but under normal cruising conditions and with the use of the radio beam such a plan is feasible.

As the curves of figure 1 leave so little room for improvement in streamlining, reduction in the actual size of areas creating resistance must be resorted to. Possible improvements of this type are: elimination of tail surfaces, full retraction of landing gear, redesign or relocation of power plants, and increase in wing loading.

Elimination of tail surfaces represents a remote possibility. Tailless airplanes lose in wing efficiency what they gain through elimination of these surfaces and the supporting body. Tail surfaces on all modern transports are of cantilever construction with a minimum of drag.

Retractable landing gears are used on most modern transports but in some, wheels protrude when in the raised position. Full retraction of both landing gear and tail wheel would eliminate both the drag and interference effects of these parts.

Drag of the engine nacelles (as shown in Table I) is approximately one fifth of the total drag. As the present nacelle shape and location have been proven by the NACA (5) to be superior to any other exterior mounting, any decrease in drag will have to come from housing the engines in the airplane structure or changing the engine design. Though one research corporation has patented a plan of installing air-cooled radial engines in the fuselage which drive wing propellers through bevel gears, the problems of odor, vibration, and noise make the plan unsatisfactory. For multi-engined airplanes, the design of a horizontally opposed engine which could be housed within the wing would be a great improvement. Such engines are used in motor coaches but none of sufficient horsepower has been developed for use in transport airplanes. Placing the engine in the wing would necessitate either forced air cooling or a return to liquid cooling.

The effect of the foregoing items on the speed of the 247-D is shown in figure 2. High speed is plotted against parasite drag in terms of equivalent flat plate area of C_D of 1.28. The profile drag coefficient and the induced drag are assumed constant. Decreased induced drag and higher *V/ND* at increased velocities would tend to further increase the velocity. The present EFPA of the 247-D is 9.83 ft.² Eliminating the tail surfaces with no loss in wing efficiency would reduce this to 7.93 and give a speed of 208 mph. Eliminating the engine nacelles would result in an EFPA of 6.34; however, drag allowance for cooling would increase this to approximately 7.0 giving a speed of 216 mph. Improved fuselage form, including full retraction of landing gear and windshield, would decrease the drag of this part about 25%, resulting in an EFPA of 8.69 and a speed of 204.5 mph.

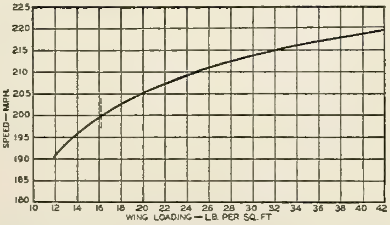
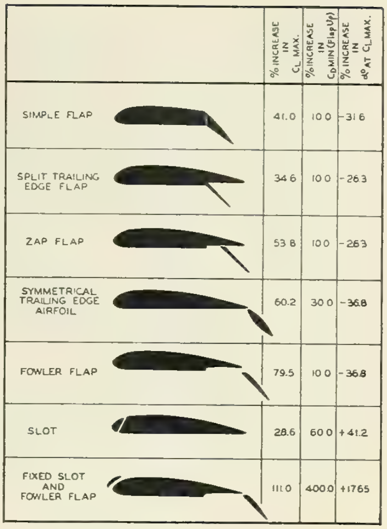


Fig. 3. Curve showing effect of wing loading of Boeing 247-D at 8000 feet



	% INCREASE IN C_L MAX.	% INCREASE IN C_D MIN (Flap Up)	% INCREASE IN $\alpha°$ AT C_L MAX.
SIMPLE FLAP	41.0	10 0	-31 6
SPLIT TRAILING EDGE FLAP	34 6	10 0	-26.3
ZAP FLAP	53 8	10 0	-26.3
SYMMETRICAL TRAILING EDGE AIRFOIL	60.2	30 0	-36.8
FOWLER FLAP	79.5	10 0	-36.8
SLOT	28.6	60 0	+41.2
FIXED SLOT AND FOWLER FLAP	111.0	400.0	+176.5

Fig. 4. Effect of lift increasing flaps and slots on airfoil characteristics

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3. Jones, B. Melville; *The Streamline Aeroplane*. Journal of The Royal Aeronautical Society, 1929.

4. Lewis, S. A. & McVitty, E. W.; *Resistance of a Cabin Fuselage with Various Windshields. Aviation engineering.* Sept., 1929.

5. Wood, Donald H.; *Tests of Nacelle-Propeller Combinations in Various Positions with Reference to Wings.* NACA TR 415, 436, 462.

Increased wing loading is undoubtedly a forthcoming improvement. To maintain safe landing speeds with such an increase necessitates the use of lift increasing devices such as flaps or slots. Figure 3 illustrates the effect of increased wing loading on the high speed of the 247-D. An auxiliary scale indicates the maximum C_L required to maintain the present landing speed. The equation of the curve of figure 3 is:

$$W/S = \frac{13{,}650}{\dfrac{18{,}430\ \text{V} - 2786}{\text{V}^4} - 1293}$$

where
W/S = wing loading
V = velocity in 100 mph

Wing span and gross weight are assumed constant. The increased V/ND would again give a slight increase in speed. Figure 4 shows a few representative lift increasing devices and their effect on wing characteristics. Most modern transports are equipped with either split trailing edge flaps or Zap flaps giving maximum C_L's slightly greater than 2. The more complicated devices such as the Fowler flap give superior aerodynamic qualities but installation difficulties at present militate against their use. However, this type will no doubt be used in the future.

By installing a Fowler flap on the 247-D (which has no lift increasing device) the maximum C_L could be increased from the present 1.665 to 2.98. From figure 3, wing loading would be increased to 29.2 and disregarding the slight increase in drag, high speed would be increased to 213.5 mph (flap weight considered off-set by reduced wing area required).

High wing loadings are desirable provided reasonable landing speeds are maintained. An airplane with a high wing loading rides smoother than one with a low wing loading due to its being less affected by air currents (6). H. A. Franchimont, chief engineer of Pan American Airways, states that wing loadings as high as 40 lbs./ft.^{2} are perfectly feasible.

Another method of decreasing wing drag is by increasing the taper. Upson and Thompson (7) have evolved an equation which is useful for comparing the drag of tapered cantilever wings of different tapers. They believe tapers as high as 8:1 are structurally possible and economically desirable. Table III shows the relative effects of different tapers on the drag characteristics of airfoils:

TABLE III: Relative Merit of Wing Tapers

Type of Wing	Relative Total Wing Drag
Untapered	100
Tapered 2: 1 planform	71.8
Same plus 2: 1 thickness	65.6
Tapered 4: 1 planform	63.0
Same plus 4: 1 thickness	60.8
Tapered 8: 1 planform	59.6
Same plus 8: 1 thickness	58.8

The 247-D has a taper of 2:1 in planform plus a 2:1 taper in thickness. A taper in planform of 8:1 would reduce the wing drag coefficient 9.2% giving a speed of 204.3 mph.

Induced drag decreases with an increase in speed so its effect becomes practically negligible at speeds exceeding 25 mph.

By combining the suggested practic methods of drag reduction, a substanti speed increase is obtained. With horizon tally-opposed wing engines, fully retrac able landing gear, and retractable win shield, the EFPA of the 247-D would 5.87 ft.^{2} Increasing the wing loading 29.2 lbs./ft.^{2} and counteracting the dra coefficient increase due to the Fowler fla by an increased taper would decrease t required wing area to 467 ft.^{2} Combinin these two items and the induced drag in one equation gives:

$$\text{Drag} = 1801 \text{ lbs.}$$

$$= 0.0242\,V^2 + \frac{5.37 \times 10^6}{V^2}$$

where
V = velocity in mph

Solution of this equation gives a hig speed of 267 mph or an increase 33.5%.

Consideration of the foregoing discu sion leads to the general conclusion th the outstanding means of improving spe performance of transport airplanes by r ducing the drag are: (a) use of mo efficient lift increasing devices, permitti increased wing loadings; (b) furth decrease in wing drag by increased tape (c) development of a horizontally-o posed type of engine; (d) full retracti of landing gear and tail wheel; and (improvement in fuselage streamline, i cluding the use of a retractable win shield.

These improvements will increase t speed of present transports as high 30% resulting in possible high speeds between 260 and 280 mph.

---

6. Franchimont, H. A.; *Basic Design Features of the Pan American Sikorsky S-42 Airplane. Aero Digest.* Sept., 1934.

7. Upson, R. H. & Thompson, M. J.; *The Drag of Tapered Cantilever Airfoils.* Journal of the Aeronautical Science. Oct., 1934.

Recent Aeronautical Patents

●

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Aircraft. Edward J. Zaparka, New York, N. Y., assignor to Zap Development Corp., Wilmington, Del. (2,039,676)

Automatic variable-pitch propeller. Chandley W. Lambert, Cleveland, Ohio. (2,039,720)

Retractable landing gear. Grover Loening, Mill Neck, N. Y., assignor to Grover Loening Aircraft Co. (2,039,813)

Apparatus for finding the course along any definite great circle. Johann M. Boykow, Berlin-Lichterfelde, Germany. (2,039,878)

Control mechanism for auxiliary wing flaps. Robert R. Osborn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,040,496)

Parachute harness. Harold G. Rogers, Buffalo, N. Y., assignor to Irvin Air Chute Co. (2,040,533)

Dirigible passenger station. Henri Rusch, St. Louis, Mo. (2,040,535)

Visual indicator for aircraft radio beacon systems. Irving J. Gallagher, Elizabeth, N. J. (2,040,734)

Magnetic compass. Paul Kollsman, New York, N. Y. (2,041,072)

Rocket engine. Walter R. Menzies, Milwaukee, Wis. (2,041,081)

Propulsion system. Alberto Zegers, Santiago, Chile, assignor to Comunidad Propulsor Chile (2,041,103)

Parachute carrier for kites. Ellsworth W. Cutshall, Houston, Tex. (2,041,233)

Gyro baseline. Leslie F. Carter, Leonia, N. J., assignor to Sperry Products, Inc. (2,041,526)

Adjustable propeller. Serge G. Kotelevtseff, New York, N. Y. (2,041,611)

Aircraft. Inglis M. Uppercu, Rumson, N. J., assignor to Burnelli Aircraft, Ltd., Keyport, N. J. (2,041,623)

Airplane construction. George E. Barnhart, Pasadena, Calif. (2,041,688)

Boundary layer control for wings, aircraft, and slotted wing —10 patents—(2,041,786, 2,04 787, 2,041,789 to (and includin 2,041,796) Edward A. Stalk Ann Arbor, Mich.

Propeller. Ernest G. McCaul Dayton, Ohio. (2,041,849)

Sight line horizon determini means. Otto Eppenstein, Je Germany, assignor to Carl Zei same place. (2,042,040)

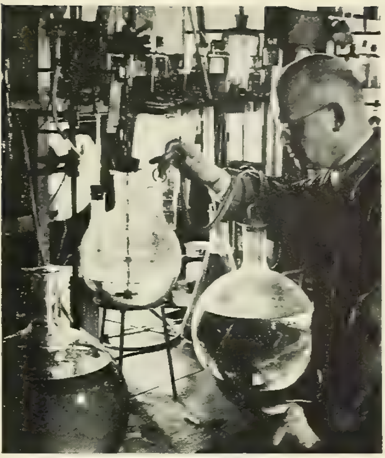
One-piece hollow steel propell Walter S. Hoover, Girard, (2,042,099)

Automatic parachute release d vice. James V. Mohler, Oelwe Iowa. (2,042,159)

Parachute rip cord assemb Edward L. Hoffman, Dayt Ohio. (2,042,466)

Altimeter for aircraft. Har A. Zahl, Long Branch, N. J. (042,490)

Thiokol—a New Material Finds Varied Aircraft Uses



Dr. J. C. Patrick, head of Thiokol's research division

● The need for a domestic supply of rubber for national defense, and the specific desire to improve the gasoline servicing hose at Government airports led the U. S. Army Air Corps, in 1933, to make complete tests of *Thiokol,* pioneer U. S. synthetic rubber. Today, this material is an official specification for such equipment.

The resistance of *Thiokol* to oil, gasoline, chemicals and to the oxidizing effects of air and ozone is the major property of the material about which revolves its importance to the aviation industry. As such it is ideal for airport service hose, airplane fuel and oil-line hose, balloon covering, and for the lining of crash-resistant tanks. As liquid sealing compound it is widely used for repairing leaky fuel tanks, and for sealing the cabins of planes to make air conditioning at altitude flying effective. Despite the present cost of the material—it sells for about 55 cents per pound as against 15 cents for natural rubber—the need for perfection and protection in airplanes has prompted its application in them. Besides, the initial cost is leveled by the service it gives.

Thiokol is a product of synthesis and is widely different in chemical composition from crude rubber. It is made in huge vats, in five hours, by chemical interaction of ethylene dichloride ($C_2H_4Cl_2$) and sodium polysulfide (Na_2S_4). It is homogeneous, firm and dense, but pliable in handling. It shows no chemical deterioration over long periods and even in its raw state it is insoluble in any of the usual solvents. On the other hand, the processing of *Thiokol* is similar to that of raw rubber, and is carried on at reduced cost due to its controlled chemical constituents. During curing any one of a number of materials such as zinc oxide and other rubber compounding materials is mixed into it.

The present inner tubing of Government airport service hose consists of 100 parts *Thiokol* and 80 parts compounding ingredients, and is a typical example of compounding synthetic rubber to meet a specification. The rubber tubing previously supplied deteriorated rapidly in use due to the vibration of the line, and the wear induced on the inner tube by the play of the liner used in the center of the connection caused failure of the part. The passage of gasoline resulted in breakdown of the walls and often caused impurities in the fuel. *Thiokol* eliminates these imperfections and fuel impurity by its imperviousness to organic solvent.

Grades of *Thiokol* tubing for use in engine and oil lines have been developed to resist by 50° to 75° temperatures exceeding 150° F.—the point at which earlier *Thiokol* materials became thermo-plastic. Accordingly, they are now in use in airplane gasoline and lubrication systems in places where heat does not exceed 225°. This application of synthetic rubber has displaced metal tubing in seaplane and airplane engines and in many instances has provided a wider latitude of design simplification than would otherwise be possible. Its use for cooling liquid hose—a potential use when development was begun—has been pretty much obviated by the popularity of Prestone for cooling airplane engines. Prestone is one of the few solvents that leave rubber unaffected. A corollary use of *Thiokol* for gasoline tubing is made in the aeroflex type of hose. In this instance *Thiokol* is used to cover a flexible aluminum hose when such hose in use is likely to come in contact with or be immersed in grease.

Raw Thiokol ready for shipment to the manufacturer

Another development for which *Thiokol* is ready for use (but which has not yet been examined thoroughly by the industry) is the crash-resistant tank. The danger of explosion from leakage from stoved-in tanks is one of the few *ex post facto* hazards of the airplane crash. A Department of Commerce report on this subject states that a *Thiokol*-lined tank provides the surest solution to the problem. The Bureau of Air Commerce, after tests with metal tanks and tanks covered with rubber had proven complete failures, turned to the idea of a flexible inner lining on metal. To quote from the report:

"The previous work of the British and of the United States Army Air Corps revealed the advantage of rubber coverings in improving the crash-resistant qualities of a tank. The use of rubber is objectionable because of the deleterious effect of gasoline. Moreover, a cover on the outside of a tank has certain disadvantages, namely, that leaks in the metal tank may escape discovery and lead to accidents, and that the cover may be cut or pierced by the sharp edges of metal after failure of the inner container. These facts and the development of new materials suggested the advantages and practicability of using flexible material as a lining on the inside of the tank. The new

(*Continued on page* 110)

The Increasing Applications of Plastics

HOWE PENNINGTON

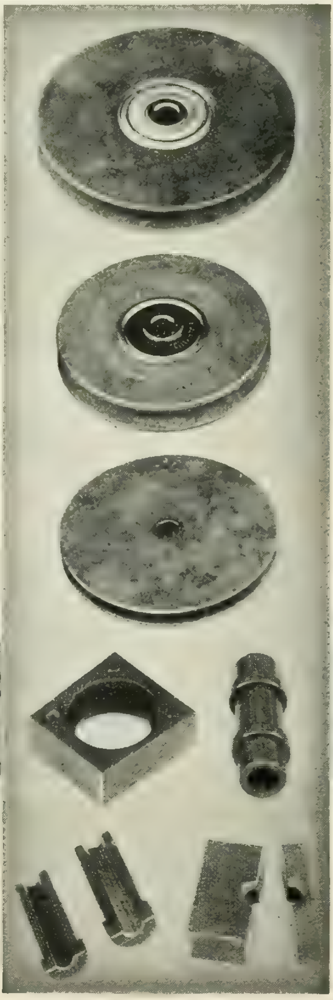
● Due to their relatively high strength/weight ratio and other favorable properties, plastics of various kinds have gained considerable use in aircraft construction. These are available in numerous forms with varying flexibility and hardness and, depending on the type selected, can be machined or molded. They can be used with or without reinforcements of fabric, paper or metal and frequently without any considerable investment in molds or other special tools; though in some cases special molding equipment is required. Little more could be said of any of the non-metallic materials suitable for aircraft use. The same basic types of materials which go to make up plastics are used for bonding and impregnating wood and are also the base of many finishes for metal, wood and other surfaces, but it is not to the latter form of applications that reference is to be made in this article.

The term "plastic" as used here—generally defined as "capable of being molded"—includes substances which are already molded or pressed into more or less unalterable shape, as well as some that are permanently cast and still others that can be reshaped by heating and molding or which are permanently soft or flexible or both. Natural rubber is the most important of all plastics, but will not be dealt with in this article, as it is in a class by itself and engineers know sufficient of its properties to use it properly.

Plastics to be considered here include: (1) the phenol-formaldehyde type, commonly referred to as phenolics. This is available in molded, laminated and cast forms under such trade names as *Bakelite, Catalin, Durez, Dilecto, Formica, Micarta, Textolite* and *Resinox*, among others; (2) the urea-formaldehyde type, (often foreshortened to "urea") available in molded and laminated forms under such names as *Beetle, Plaskon, Unyte* and *Dilecto U. F.;* (3) the nitrocellulose or pyroxylin type, available in sheet, rod and tube under such names as *Celluloid, Fiberloid* and *Pyralin;* (4) the cellulose acetate type available in molded and in sheet, rod and tube forms under such names as *Fibestos, Lumarith, Plastacele, Tenite* and *Masuron;* and (5) the synthetic rubber types which include *Thiokol* and *Duprene*.

There are several other types and makes, such as *Victron*, a meta-styrol plastic, which finds limited use in aircraft radio parts. However, those mentioned above are by far the most important types employed. Of the five listed, the nitrocellulose (3) and the cellulose acetate (4) are used chiefly (if not solely, so far as aircraft are concerned) in transparent sheet for window lights and screens or as the center layer in safety glass. In appearance, these plastics are practically identical, but the nitrocellulose type is highly inflammable—burning explosively when ignited—tends to discolor and to become brittle under exposure to sunlight and scratches easily. The acetate, though about as inflammable as paper, is relatively slow burning as compared to nitrate and is not considered a fire hazard. It withstands weathering somewhat better than the nitrate and is made in a form which does not craze or check, but it becomes quite brittle at low temperatures, is easily scratched and is prone to crack

Typical standard Formica (laminated phenolic) pulleys, fair leads and bushings available for aircraft



Plaskon instrument dials used on automobiles and adaptable for airplanes

Molded urea parts, including dome light covers, knobs, buttons and handles

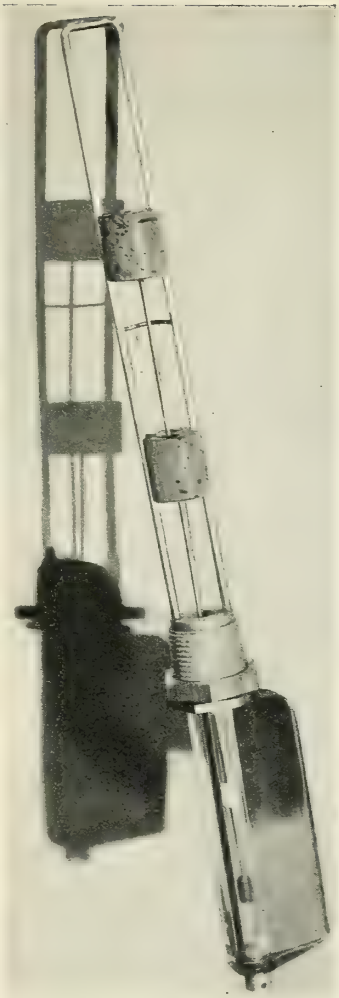
Bakelite case for Pioneer Rate-of-climb indicator

after prolonged and continuous service.

Both the nitrate and the acetate are lighter than glass, having a specific gravity ranging from about 1.27 to 1.35. They are also usable in thinner sections, and of course are far less friable, i.e. are substantially non-shattering. They are quite flexible when new, at normal temperature, but are easily scratched by dust and in cleaning, thus reducing clarity and range of vision through them. For this reason, the Buureau of Standards and the N.A.C.A. are cooperating in an effort to find better materials to substitute for the acetate and nitrate now used. The acetate molds readily from powder, and is available in many colors and striated effects for making knobs, handles and other similar parts, though other plastic materials are less expensive and equally good for such use. In general, the price of nitrate runs from about $1 a pound upward (depending on thickness and other factors) and acetate is usually about 10% higher in price, though some molding forms can be had for about 60 cents a pound.

Transparent sheet made from *Pyralin* (nitrocellulose) and from *Pastacele* (cellulose acetate) is widely used in aircraft for transparent windows, windowscreens and cockpit enclosures.

Phenolic plastics (1) have by far the widest use in aircraft parts of any of the plastics considered here, though this may not be true in all individual ships, especially now that synthetic rubbers are coming rapidly into use. In general, phenolics are the least expensive of the plastics useful in aircraft. They are strong, non-inflammable, resistant to weathering, oil, water and chemicals, and are available in many forms. Of these, much the strongest and most shock-resistant type is the laminated form which has a fabric filler, though the paper-filled laminated type is usually stronger than those molded forms made with wood flour. Fabric-filled laminated can be had with an ultimate tensile strength as high as 24,000 p.s.i., and as its specific gravity is about 1.38 average (roughly half that of aluminum) it will be seen that its strength/weight ratio is high. The maximum ultimate strength in bending is about 30,000 p.s.i., in compression about 43,000 p.s.i. and in shear about 11,000 p.s.i. maximum. Impact strength is also high and the fabric-filled type, in particular, is free from the brittleness sometimes associated with the ordinary wood-flour-filled molded phenolics.



Level gage for gravity fuel tank, the head of which is of transparent Catalin which is easily machined

An indication of the strength of the fabric-filled phenolic may be gained when it is realized that propellers molded from this material and capable of carrying more than 1300 hp have been used successfully and probably would be in extensive use today except for the cost of the large and expensive molds needed to produce them. With propeller design changing rapidly and relatively few of a given design required, mold cost thus far has been prohibitive.

A good part of the Fairchild aerial camera is made from *Bakelite,* one of the phenolic plastics, because of its light weight and other properties of molded and laminated products produced from this type. Perforated *Formica* is sometimes used over a backing of cloth and flame-proof *Seapak* for sound absorption purposes. The *Formica* surface has great longevity and can be washed without injury.

Control stick handles of Bakelite cast resinoid

Laminated phenolics are made in sheet, rod and tube in a wide range of section thicknesses and can be cut to the size and shape required by ordinary machining methods. Thin sheets can be bent and punched in some cases and while certain of the thin forms are somewhat translucent, they are not transparent. A recent development is a thin translucent sheet used, as yet, only in radio dials but likely to gain other application soon. Laminated phenolics are non-inflammable, as are all the other forms of phenolic plastics. The laminated form is employed for cabin panelling, aileron pulleys and fairlead bushings, as well as for fuse and radio panels and for certain insulating parts. It has been suggested for wing covering and structural wing parts, but the writer knows of no specific applications of this kind.

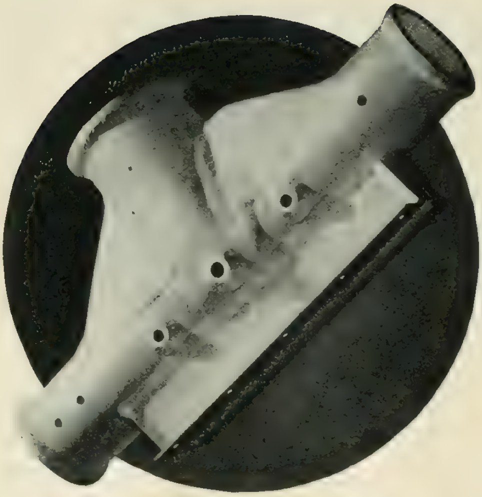
Molded phenolics are made in much more complex forms than the laminated types and have similar properties, though they are, in general, somewhat inferior in strength. Much depends, however, on the specific types compared. The strength and some other properties of molded forms (as well as of laminated forms) depend largely on the type of filler used. Parts molded from compounds having a wood-flour filler are less shock-resistant than those with a shredded fabric filler, but the latter form is more expensive and considerably harder to mold. Compounds having a mineral filler possess higher heat and water resistance but are heavier than the wood-flour and fabric-filled types. Phenolic molding compounds, but not in molded form, range in price from about 12 cents a pound upward, depend-

(*Continued on page* 112)

Chrome Molybdenum Steel for Aircraft

A. J. HERZIG

Chief Metallurgist, Climax Molybdenum Co.

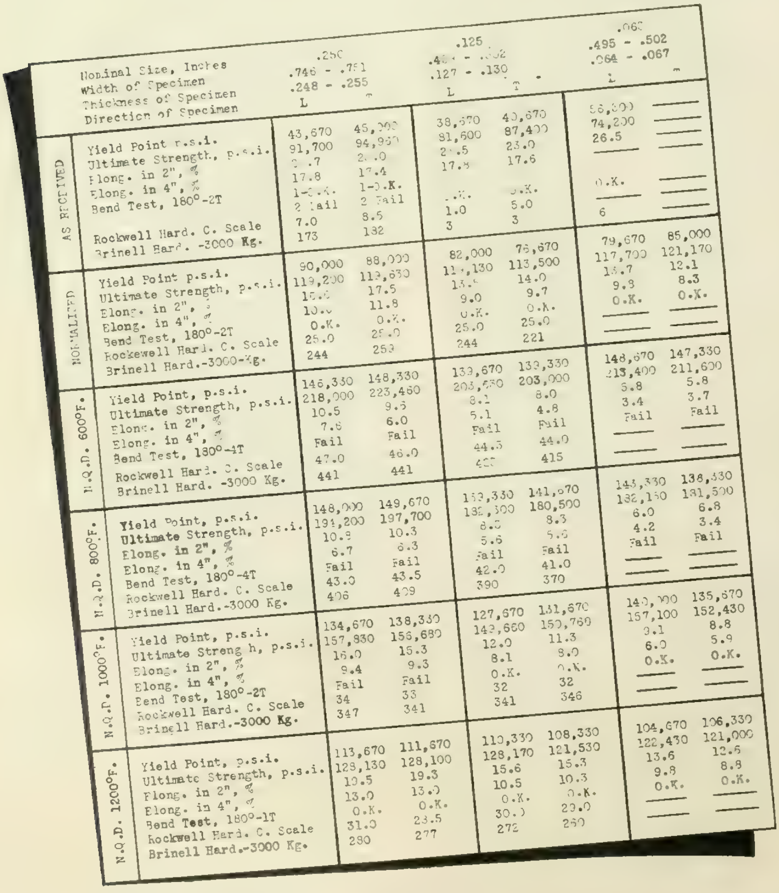


Martin control column fitting made of 22 separate parts welded of bar, sheet and tube

● Chrome-molybdenum steel classified as SAE 4130X has gained a well-established reputation in aircraft and aircraft engine manufacturing procedure by reason of its satisfactory welding characteristics and high strength/weight ratio.

In analysis, this steel contains .25-.35% carbon; .40-.60% manganese; .05% max. sulphur; .04% max. phosphorous; .80-1.10% chromium and .15-.25% molybdenum, thus corresponding to A & N standards for aircraft materials. With this analysis, this steel is readily fabricated into seamless tubing, as well as into sheet and bar stock. It will withstand severe cold forming, as in the manufacture of fittings, and can readily be forged.

Characteristics of this steel necessitate a pouring temperature of 2880° to 2915° F., a forging temperature of 2100° F., and a rolling temperature ranging from 2250° to 2350° F. Forgings should not be finished under 1800° F., and billets of 8″ or over below 1950° F. Billets should be slow cooled through the transformation range after rolling. Normalizing should be done at 1650° F., cooled in air, while temperatures for the oil or water quench should range from 1550° to 1650° F.



	Nominal Size, Inches	.250		.125		.063	
	Width of Specimen	.746 - .751		.4[illegible] - .502		.495 - .502	
	Thickness of Specimen	.248 - .255		.127 - .130		.064 - .067	
	Direction of Specimen	L	T	L	T	L	T
AS RECEIVED	Yield Point p.s.i.	43,670	45,000	38,670	40,670	56,000	—
	Ultimate Strength, p.s.i.	91,700	94,950	81,600	87,400	74,200	—
	Elong. in 2″, %	[illegible].7	2[illegible].0	2[illegible].5	23.0	26.5	—
	Elong. in 4″, %	17.8	17.4	17.8	17.6	—	—
	Bend Test, 180°-2T	1-O.K. 2 Fail	1-O.K. 2 Fail	O.K.	O.K.	O.K.	—
	Rockwell Hard. C. Scale	7.0	8.5	1.0	5.0	—	—
	Brinell Hard. -3000 Kg.	173	182	3	3	6	—
NORMALIZED	Yield Point p.s.i.	90,000	88,000	82,000	76,670	79,670	85,000
	Ultimate Strength, p.s.i.	119,200	119,630	11[illegible],130	113,500	117,700	121,170
	Elong. in 2″, %	15.[illegible]	17.5	13.[illegible]	14.0	13.7	12.1
	Elong. in 4″, %	10.[illegible]	11.8	9.0	9.7	9.8	8.3
	Bend Test, 180°-2T	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
	Rockewell Hard. C. Scale	25.0	25.0	25.0	25.0	—	—
	Brinell Hard.-3000-Kg.	244	253	244	221	—	—
N.Q.D. 600°F.	Yield Point, p.s.i.	146,330	148,330	139,670	139,330	148,670	147,330
	Ultimate Strength, p.s.i.	218,000	223,460	203,650	203,000	213,400	211,600
	Elong. in 2″, %	10.5	9.5	8.1	8.0	5.8	5.8
	Elong. in 4″, %	7.6	6.0	5.1	4.8	3.4	3.7
	Bend Test, 180°-4T	Fail	Fail	Fail	Fail	Fail	Fail
	Rockwell Hard. C. Scale	47.0	46.0	44.5	44.0	—	—
	Brinell Hard. -3000 Kg.	441	441	4[illegible]	415	—	—
N.Q.D. 800°F.	Yield Point, p.s.i.	148,000	149,670	153,330	141,670	143,330	138,330
	Ultimate Strength, p.s.i.	194,200	197,700	182,300	180,500	132,150	131,500
	Elong. in 2″, %	10.9	10.3	8.6	8.3	6.0	6.8
	Elong. in 4″, %	6.7	6.3	5.6	5.6	4.2	3.4
	Bend Test, 180°-4T	Fail	Fail	Fail	Fail	Fail	Fail
	Rockwell Hard. C. Scale	43.0	43.5	42.0	41.0	—	—
	Brinell Hard.-3000 Kg.	406	409	390	370	—	—
N.Q.D. 1000°F.	Yield Point, p.s.i.	134,670	138,330	127,670	131,670	140,000	135,670
	Ultimate Streng h, p.s.i.	157,830	156,680	149,660	150,760	157,100	152,430
	Elong. in 2″, %	16.0	15.3	12.0	11.3	9.1	8.8
	Elong. in 4″, %	9.4	9.3	8.1	8.0	6.0	5.9
	Bend Test, 180°-2T	Fail	Fail	O.K.	O.K.	O.K.	O.K.
	Rockwell Hard. C. Scale	34	33	32	32	—	—
	Brinell Hard.-3000 Kg.	347	341	341	346	—	—
N.Q.D. 1200°F.	Yield Point, p.s.i.	113,670	111,670	110,330	108,330	104,670	106,330
	Ultimate Strength, p.s.i.	128,130	128,100	128,170	121,530	122,430	121,000
	Elong. in 2″, %	19.5	19.3	15.6	15.3	13.6	12.6
	Elong. in 4″, %	13.0	13.0	10.5	10.3	9.8	8.8
	Bend Test, 180°-1T	O.K.	O.K.	O.K.	O.K.	O.K.	O.K.
	Rockwell Hard. C. Scale	31.0	23.5	30.0	29.0	—	—
	Brinell Hard.-3000 Kg.	280	277	272	260	—	—

Table 1. Chemical analysis and dimensions of test specimens

Bar stock should be capable of developing physical properties showing 125,000 p.s.i. tensile strength (min.), 100,000 p.s.i. yield point (min.), and 18% elongation in 2″. Bend test specimen in the heat treated condition should conform to the above tensile properties and should be capable of withstanding cold bending without cracking through an angle of 180° over a radius equal to the diameter, or at least, to the thickness of the specimen.

Physical properties for sheet or strip in the normalized or quenched and drawn condition are 90,000 p.s.i. tensile strength (min.) and 70,000 p.s.i. yield point (min.). Elongation in 2″ for sheets thicker than 3/16″ is twenty percent; for sheets ranging from 1/8″ to 3/14″, fifteen percent; 1/16″ to 1/8″, twelve percent; and less than 1/16″, ten percent. Bend test specimens should withstand cold bending without cracking through an angle of 180° for sheets up to 1/16″ thickness, 135° for 3/16″-1/4″, and 90° for sheets exceeding 1/4″, over a diameter equal to the thickness of the material.

It is advisable that a standard form of test specimen should be used when testing sheets because of the naturally wide variation between sheets of different thicknesses. When this is impossible due to laboratory conditions, the relationship between the elongation gage length and the area of the cross section may be obtained by the use of Bertella's equation for the accompanying logarithmic curve.

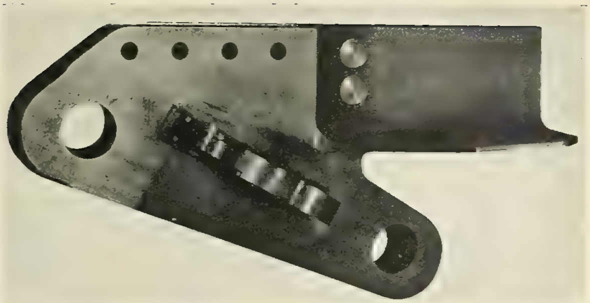
The form of this curve is:

$$e = K(L\sqrt{A})^n$$

where

e = percentage of elongation
K = 60 from the curve
n = .55 from the curve
L = gage length
A = area of cross section

Table 1 shows approximate dimensions of test specimen used for thickness of sheet tested and the physical properties in the "as received," normalized, water quenched and drawn conditions. In this table L refers to longitudinal; T, transverse; N, normalized; Q, water quenched; and D, drawn. The bend test 180° 2T designates a 180° bend over a mandrel equivalent to 2 × the thickness of specimen. Practically all figures are average of three tests.



A main wing fitting, made of a Chrome Molybdenum forging, for the Martin type 130 flying boat

It is evident from this table that the properties of the steel "as received" from the mill are erratic. Doubtless this wide variation is due primarily to different finishing temperatures and cooling rates after rolling. An examination of the structure of the sheets "as received" showed that these erratic properties were to be expected.

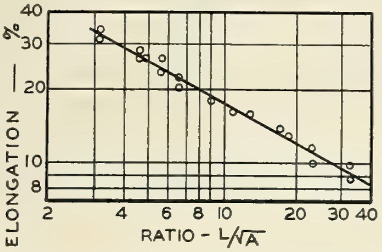


Chart showing general relationship between elongation gage length and area as given by Bertella's equation

It is interesting to note the close agreement between the longitudinal and transverse properties obtained on each size sheet. The steady decrease in elongation as the gage becomes thinner is also worthy of note. The table shows that the steel hardened and tempered at 600° and 800° F. is too brittle to pass a bend test requirement, even though a mandrel equivalent to four times the thickness is permitted. With a tempering temperature of 1000° F. all sizes below ⅛" should pass a bend test over two thicknesses, and when tempered at 1200° F. all sizes should pass a bend test for a mandrel equivalent to one thickness.

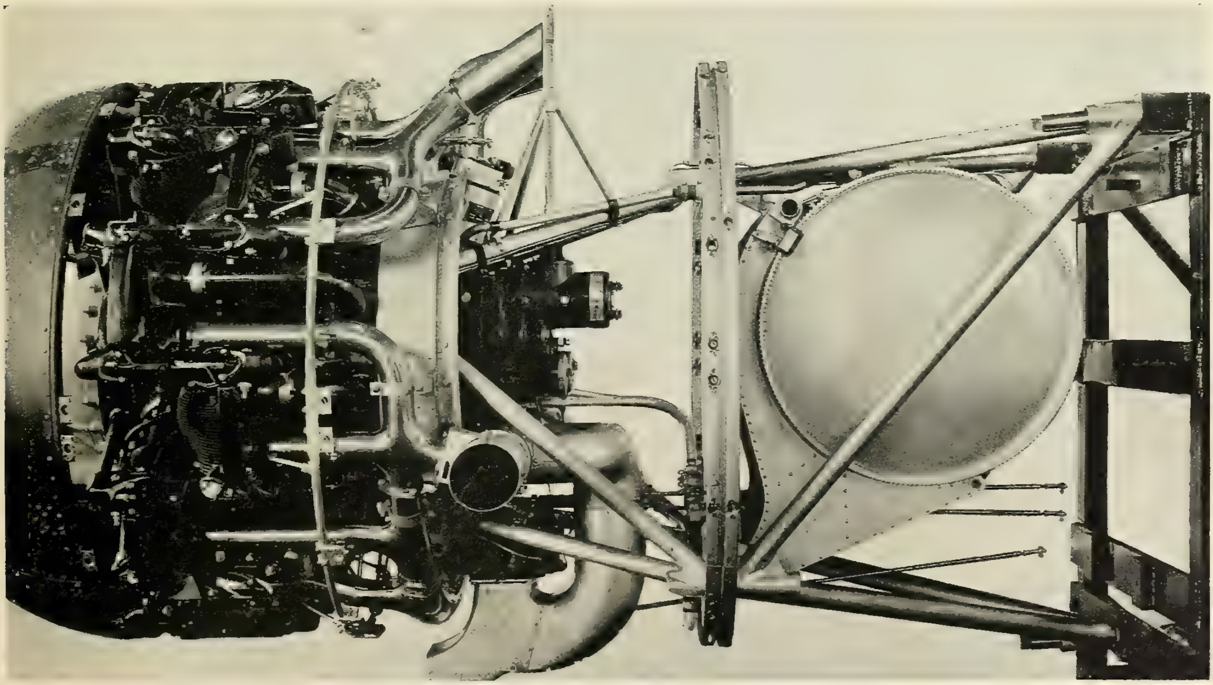
TABLE 2

Type of Steel	Grade Commercial	Mild Carbon Normalized	Chrome Molybdenum Normalized	Chrome Molybdenum Heat Treated
Tube	A	B	C	D
S.A.E. Number	1015	1025	4130X	4130X
Ultimate Strength (p.s.i.)	40.000	55,000	95,000	200,000
Breaking Strength of Tube (lbs.)	23,600	25,800	25,600	27,700
Size (diameter of wall included)	1 X .250	1 X .187	1 X .096	1 X .047
Weight per foot (lbs.)	2.00	1.65	0.92	0.50

Probably the best combination of physical properties, including strength and ductility, will be obtained after a drawing temperature of about 1100° F.

Tubing should be annealed or normalized to remove the effects of cold drawing and to develop certain physical properties. Tubing with wall thicknesses up to and including .035" should have a minimum tensile strength of 95,000 p.s.i., minimum yield strength of 75,000 p.s.i., and a minimum elongation in 2" of 10% for a full tube and 5% for strip; tubing with wall thicknesses from .035" to .186" inclusive, should have a tensile strength (min.) of 95,000 p.s.i., yield strength (min.) of 75,000 p.s.i. and a minimum elongation in

(Continued on page 36)

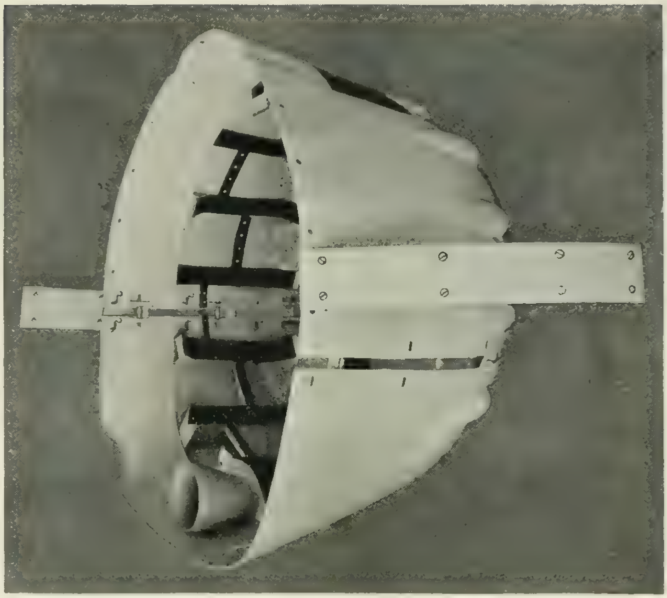


Chrome Moly welded steel engine mount of the Martin 130. Frame weight, 74 pounds; engine weight, 2380 pounds

Tests on Dzus Self-Locking Fasteners

FREDERICK K. TEICHMANN

Ass't Prof., Daniel Guggenheim School of Aeronautics,
New York University



Typical use of Dzus fasteners on the engine cowl of a modern plane

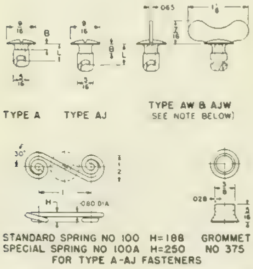
● The self-locking fastener manufactured by the Dzus Fastener Co., Inc., was subjected to a series of tests recently at the Daniel Guggenheim School of Aeronautics, New York University. In these tests for wear qualities and resistance to vibration, it was ascertained that the units possess adequate strength characteristics and successfully withstand continued vibration.

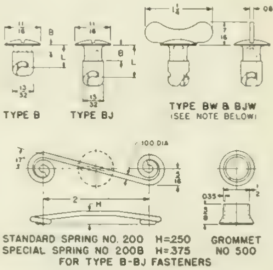
Dzus fasteners may be mounted either flush with the exterior surface, or with a slight oval head extending slightly above the surface. A spring is rivetted to the fixed part of the structure, the fastener is inserted through a hole and is then engaged with the spring by a quarter turn of the fastener. The operation of engaging and dis-engaging the fastener is easy and rapid by means of an ordinary screw driver, small coin, or a special fastener key. Where installations permit their utilization, wing type fasteners are used. These are locked and unlocked by turning the wing with the thumb and forefinger.

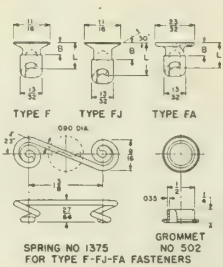
In general, these fasteners are desirable for parts of the structure requiring quick assembly and disassembly for maintenance and accessibility. They are used to fasten down engine cowls, battery box covers, access plates and handhole covers, for individual assemblies of instrument panels, fairing attachments, fillets between tail surfaces and fuselage, covers for camera recesses, floor boards, for fastening chairs to floors, furniture covers, interior upholstery and paneling, baggage compartment doors, wheel pants, windshields, radio installations, etc. They also have varied uses in the shop for jigs and fixtures.

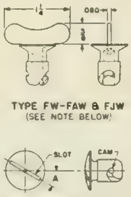
The fasteners are designed so that no part can be lost or misplaced after the installation is completed. They are made of nickel steel, heat treated and then

(Continued on following page)







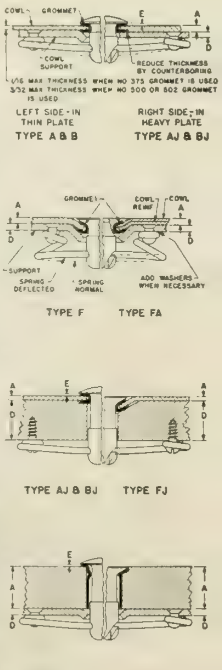


TYPE OF FASTENER	APPROXIMATE ANGLE A
A-AJ	30°
B-BJ	17°
F-FA-FJ	23°

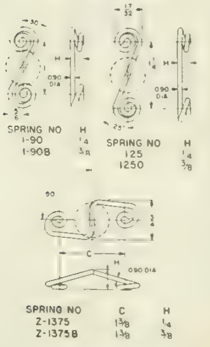
RECOMMENDED DEFLECTION FOR SPRING NO 100 & 100A=.047 – FOR ALL OTHERS .062

MOUNTING HOLES IN ALL SPRINGS ARE 1/8 DIA.

TYPICAL INSTALLATIONS


COWL
GROMMET
COWL SUPPORT
REDUCE THICKNESS BY COUNTERBORING
1/16 MAX THICKNESS WHEN NO 375 GROMMET IS USED
3/32 MAX THICKNESS WHEN NO 500 OR 502 GROMMET IS USED
LEFT SIDE-IN THIN PLATE
TYPE A & B
RIGHT SIDE-IN HEAVY PLATE
TYPE AJ & BJ
GROMMET
COWL REINF
COWL
SUPPORT
SPRING DEFLECTED
SPRING NORMAL
ADD WASHERS WHEN NECESSARY
TYPE F
TYPE FA
TYPE AJ & BJ
TYPE FJ
TYPE AJ & BJ
TYPE FJ

SPECIAL SPRINGS

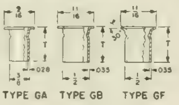


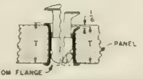
SPECIAL SPRINGS SHOWN ABOVE ARE FOR SPECIAL INSTALLATIONS FOR TYPE B-BJ-F-FJ FASTENERS ONLY. SPRING NO 1-90 IS FOR CORNER INSTALLATIONS

TYPE	FASTENER PART NOS	30	35	40	45	46	50	56	60	70	80	90	100	LONGER BY INCREMENTS OF 100 TO	250
	DIMENSION L	300	350	400	450	460	500	560	600	700	800	900	1 000		2 500
A	DIMENSION B	100	100	100			100		100	100	100	100	100	REMAINS 100 –	100
	MATERIAL GRIP	130	180	230			330		430	530	630	730	830	INCREASES BY 100 TO	2 330
	GROMMET NO	375	375	375			375		375	375	375	375	375	375	375
	COMB WEIGHT	014#	0 49#	0·58#			0175#		0192#	.0209#	0226#	0243#	026#	TO	051#
AJ	DIMENSION B		125	190	190		250		300	400	500	600	700	REMAINS 700 –	700
	MATERIAL GRIP		180	230	280		330		430	530	630	730	830	INCREASES BY 100 TO	2 330
	GROMMET NO		375	375	375		375		375	GA-45	GA-55	GA-65	GA-75	" " " "	GA 225
	COMB WEIGHT		0145#	0149#	0134#		0162#		0175#	0·94#	020#	0226#	0242#	TO	054#
B	DIMENSION B			125			125		125	125	125	125	125	REMAINS 125 –	125
	MATERIAL GRIP			175			275		375	475	575	675	775	INCREASES BY 100 TO	2 275
	GROMMET NO			500			500		500	500	500	500	500	500	500
	COMB WEIGHT			0269#			0295#		0319#	0346#	0369#	0397#	0423#	TO	081#
BJ	DIMENSION B			188			250		300	350	450	550	650	REMAINS 650 –	650
	MATERIAL GRIP			175			275		375	475	575	675	775	INCREASES BY 100 TO	2 275
	GROMMET NO			500			500		500	GB-40	GB-50	GB-60	GB 70	" " " "	GB 220
	COMB WEIGHT			.0252#			0278#		0313#	0325#	0348#	0372#	0397#	TO	085#
F	DIMENSION B						234		234	234	234	234	234	REMAINS 234 –	234
	MATERIAL GRIP						140		240	340	440	540	640	INCREASES BY 100 TO	2 140
	GROMMET NO						502		502	502	502	502	502	502	502
	COMB WEIGHT						0281#		0334#	0357#	038#	040#	042#	TO	077#
FA	DIMENSION B					250		250		USE SPRING NO 200 INSTEAD OF 1375					
	MATERIAL GRIP					100		200							
	GROMMET NO.					502		502							
	COMB WEIGHT					.0287#		0318#							
FJ	DIMENSION B						250		300	350	450	550	650	REMAINS 650 –	650
	MATERIAL GRIP						140		240	512	612	712	812	INCREASES BY 100 TO	2 312
	GROMMET NO.						502		502	GF 40	GF 50	GF-60	GF 70	" " " "	GF-220
	COMB WEIGHT						.0281#		.0326#	033#	035#	037#	039#	TO	081#

FASTENERS LEFT OF HEAVY LINE ARE CARRIED IN STOCK ALL OTHERS MADE ON ORDER
MATERIAL GRIP=COMBINED THICKNESSES OF 2 OR MORE SHEETS OR PANELS THAT CAN BE HELD BY STD PARTS
COMBINED WEIGHT=WEIGHT OF SPRING, FASTENER AND GROMMET

SPECIAL GROMMETS





TYPICAL UNIT ASSEMBLIES

GROMMET NO	DIM T	GROMMET NO	DIM T
GA-45	450	GB OR GF-40	400
GA-55	550	GB OR GF-50	500
GA-65	650	GB OR GF-60	600
GA-75	750	GB OR GF-70	700
LONGER BY INCREMENTS OF 100 TO			
GA-225	2 250	GF OR GB-220	2 200

WHEN BOTTOM FLANGE IS REQUIRED, ADD LETTER "F" TO THE TYPE IDENTIFICATION OF THE GROMMET. FORM BOTTOM FLANGE ON INSTALLATION

Technical data and dimensions of several types of Dzus self-locking fasteners, their assembly and installation

"The GREATEST NAME IN RUBBER"
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MOST people, when they hear the name "Goodyear," think first of tires, tubes—and other rubber products.

But, in the airplane industry, a broader meaning attaches to this name. Here, Goodyear stands also for pioneering in the development of brakes, controls and wheel equipment for all types and sizes of airplanes–equipment which has contributed its share to the advancement of flying and the design of ships.

Goodyear literally grew up with the airplane industry.

And this shoulder-to-shoulder association has provided both the experience and inspiration for the long list of Goodyear "firsts"—among them, the Airwheel, first and only super-soft tire—the first hydraulic brake design developed exclusively for airplanes, rather than simply borrowed from the automobile; the first *pneumatic* airplane brake in America; and a dependable line of mechanical and hydraulic controls.

UNDER THIS FLAG

GOOD YEAR

OF LEADERSHIP

•

HIGH PRESSURE TYPE

Clincher cords · Straight Side cords · Heavy Duty cords · Drop Center type · Flat Base type · Smooth tread · Non-skid tread · 16 sizes 10 x 3 up to 54 x 12 with tubes —regular and puncture seal

AIRWHEEL* EQUIPMENT

14 sizes 12 x 5-3 up to 45 x 20-10 with tubes · Re-liners to increase puncture resistance · Tailwheel hubs and self-contained bearing adjustment sleeves · No brake type wheels · Wheels with mechanical band type brakes · Wheels with Goodyear hydraulic disc type brakes · Wheels with Goodyear pneumatic disc type brakes · Controls—including master cylinders, hydraulic hose and special fittings for hydraulic lines · Pneumatic metering valves and air compressors

INTERMEDIATE OR LOW PRESSURE TYPE

8 sizes 18 x 8.00-5 up to 55 x 19.00-23 with tubes—regular and puncture seal. Wheels with hydraulic disc type and pneumatic disc type brakes · Same complete line of controls as for Airwheels

STREAMLINE TYPE

For landing wheels—7 sizes · For tailwheels—6 sizes · Regular and puncture seal tubes · Cantilever-type tailwheels · Fork-type tailwheels · Axles and spacers

If you have a tough problem, involving brakes, controls or tires, Goodyear would like to tackle it. Just write Aeronautics Department, Goodyear, Akron, Ohio—or Los Angeles, California.

*If it isn't a Goodyear, it isn't an Airwheel! AIRWHEEL *is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of* AIRWHEEL *Tires*

THE GREATEST NAME IN RUBBER

GOODYEAR

(Continued from preceding page)

cadmium plated. Springs are cadmium plated nickel wire and grommets are of aluminum. Material used for the wing is either cadmium plated steel, or anodized duralumin.

Type A fastener has a tensile strength at the breaking point of 1000 lbs., a tension of 50 lbs., and a shearing strength of 1100 lbs. Types B, F, and FA have a tensile strength of 1500 lbs., a tension ranging from 50 to 65 lbs., and a shearing strength of from 1400 to 1600 lbs.

Two types of tests were made at the University. One, a pull test, was to determine the holding power of the fasteners; the other, a wear or reversal test, was to determine their life expectancy.

Customary tests made to determine the pulling strength of cowl fasteners usually employ specimens incorporating a section of the model to be fastened together. These tests invariably resulted in failure of the incorporated section first, and then secondary failure in the fastener itself. A special holding tool was therefore devised whereby the true holding power of the fastener could be obtained.

Tests indicated that the fasteners have a holding power in excess of the strength likely to exist in the attaching model sheet. For example, tests on the fastener known as Type B, F, or FA, with a body diameter of 13/32″, average 1811 lbs. for 11 specimens.

Tests on fasteners known as Type A, or AF, with a body diameter of 5/16″, averaged 1048 lbs. for 11 specimens.

Wear tests consisted of a cyclic operation of the fastener, first closing and then opening the fastener at a rate of 30 per minute. A condensed log of the tests is given in the following:

First Series: Specimen #1 B-40 type fastener, straight spring; recommended deflection .062″; actual deflection 1.25″. Specimen #2 B-40 type fastener, right angle spring; recommended deflection .062″; actual deflection 1.25″. Specimen #3 A-30 type fastener, straight spring; recommended deflection .062″; actual deflection 1.25″.

After 27,210 reversals, spring of #2 specimen failed. At 44,610 reversals, remaining two springs showed cracks.

Tests discontinued after 64,920 reversals. No complete failure of springs in spite of cracks. Slight wear on cams of fastener.

Second Series: Specimen #1 B-40 type fastener, straight spring and specimen #2 B-40 type fastener, right angle spring; spring deflection .062″. Specimen #3 A-30 type fastener, straight spring; spring deflection .047″.

After 32,400 reversals, only slight wear on springs noticeable. After 39,000 reversals, cam of A-30 type of fastener worn down and therefore test on this specimen discontinued. After 73,800 reversals, tests discontinued. Remaining fasteners showed negligible wear.

CHROME MOLYBDENUM STEEL FOR AIRCRAFT

(Continued from page 33)

2″ of 12% for a full tube and 7% for strip; tubing with wall thickness over .186″ should have a tensile strength (min.) of 90,000 p.s.i., yield strength (min.) of 70,000 p.s.i., and a minimum elongation in 2″ of 15% for a full tube and 10% for strip. Table II shows a comparison of strength/weight factors of typical materials used in aircraft construction.

Welding of SAE 4130X Steel

Recommended welding practice in aircraft construction is practically the same whether the material is in the form of sheets or tubes. The majority of welds are made with gas, principally because it is better fitted for welding the thin sections customarily used. Where sections are ⅛″ or more, electric welding is sometimes used.

It is usually possible to make good joints with either thin tubes, or sheets without preparing the edges, although it is necessary that edges be clean. In cases where sections are ⅛″ or more, edges should be beveled about 45°.

In gas welding, a soft neutral flame should be used, inasmuch as oxidizing flame not only tends to burn the steel and weaken it, but it also causes cracks from contraction during cooling. An excess acetylene flame makes the metal brittle from carburization.

The flame should be directed on the work at such an angle that preheating of the metal ahead of the weld takes place as the weld advances. In working, either on sheets or tubes, it is good practice to weld in an atmosphere of hydrogen, preferably a hydrogen flame. This aids the prevention of oxidation and also adds to the strength of the finished parts by eliminating localized air hardening around the weld.

If jigs or fixtures are utilized, they should be designed to allow for the contraction that takes place as the metal cools. The metal being welded should be protected from drafts of air, otherwise, it will chill and contract too fast and strain the part that is still hot.

Welding Rod

General recommendations for gas welding call for a carbon steel rod with a maximum carbon content of .18%, although it is claimed that a rod with .10% carbon gives even better results. One rod analysis given is .18% carbon and .60% manganese, and in some cases (especially in arc welding) a rod of an analysis similar to that of the parent metal is used.

Although it is not always necessary to heat treat welded 4130X assemblies, if normalizing or hardening and drawing can be performed, the physical properties of the assembly will be improved if this is done. Heat of the welding operation will cause a decrease in the tensile properties in the zone which has been heated just under the critical and cooled in air, but this loss, however, will generally not exceed 10% of the original tensile strength of the steel.

To obtain uniform properties, it is necessary that the grain size be fine and uniform in all parts of the sheet, and the sheet should not be decarburized to the point where its physical properties are affected. The finished surface should be free from scale that would interfere with laying out fittings.

Average results of several tests made on welded specimens show that a sheet .025″ in thickness had a tensile strength of 92,000 p.s.i. before welding, whereas after welding this strength averaged 91,000 p.s.i., with the maximum at 95,000 and the minimum at 85,000 p.s.i. A sheet .039″ in thickness showed 105,000 p.s.i. tensile strength before welding and an average, after welding, of 90,000 p.s.i., with the maximum at 104,000 p.s.i., and the minimum, 82,000 p.s.i. These results were obtained from both plain butt welds and T welds, made with both low-carbon welding rods and with chrome-molybdenum steel welding rods of the same analysis as the sheet, except that the carbon content was .15%.

Unheat-treated Joints

For the unheat-treated welded joints, the low-carbon rod is satisfactory and is preferred inasmuch as the weld metal is more ductile than that deposited with chrome-molybdenum rod. In the case of heat treatment where high strength is desired in the weld metal, the chrome-molybdenum rod gives good results. In the case of heat treated welds, care must be taken that there is complete fusion of the weld metal into the corner of the abutting sheets for a T weld and that the fillet is built so that the shearing stresses in the weld metal are not more than 50% of the tensile stresses in the base metal.

Indicating the effect of heat treatment on physical properties of welded 4130X tubing, it is seen that where a tube was not heat treated after welding it had a tensile strength of 95,000 p.s.i., a yield point of 60,000 p.s.i., and an elongation in 2″ of 12%. Normalized at 1500-1600° F., this tube increased in tensile strength to 100,000 p.s.i., in yield point to 80,000 p.s.i., and elongation to 15%. Oil quenched at 1600° F., and drawn, the tube showed 200,000 p.s.i. tensile strength, and 150,000 p.s.i. yield point.

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Nickel Steels and Alloys in Aircraft Engines

● No other phase of transportation depends so strongly on the maintenance of low weight-to-power ratio in its carrier engines as does the aeronautical. Because of this, every year of aviation's development has witnessed startling reductions in dead weight, either through fundamental design innovations or by the development of lighter, stronger materials of construction. The original Wright engine weighed 21 lbs./per hp. Today commercial radial air-cooled engines weigh as little as 1.2 lbs./per hp, and are, furthermore, many times faster, sturdier and more efficient.

It is a truism that the widespread use in engine construction of strong, tough and dependable nickel steels and alloys has made possible the modern aircraft power plant. Most of the steels used conform to the composition specifications of the Society of Automotive Engineers, and are often referred to, therefore, as Automotive Steels. Their applications in aircraft engine construction follow analogous lines; because of the greater stress and wear factors present, and the necessity for the absolute weight-to-power minimum in any case, aviation has tended to concentrate on the use of the higher alloyed members of the series.

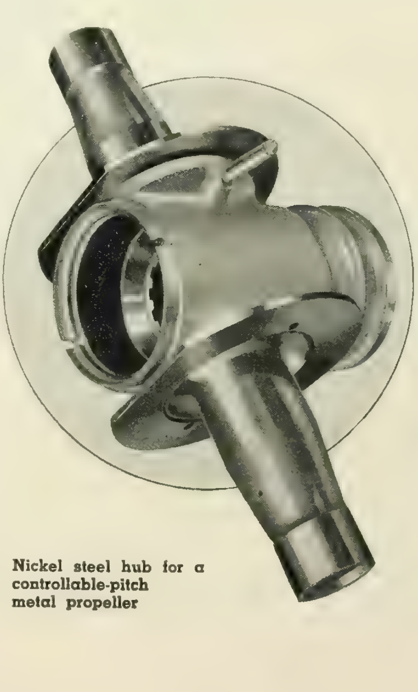
The nickel alloy steels used in aircraft engine parts may be divided into two classes: (1) the case-hardening, low carbon (less than .25%C.) steels, which are used where a hard, wear resistant surface is required together with maximum internal toughness or resistance to shock and (2) the oil- and water-hardening steels, containing between .30 and .70% carbon, and frequently used where machining is done after heat treatment, to provide smooth, bright scale-free surfaces, with accuracy of dimensions in the finished parts. The following discussion of the individual steels of each group has been supplemented with the accompanying table in which appear some of the established applications of each of the more important nickel, nickel-chromium or nickel-chromium-molybdenum steels in aircraft engine construction.

Low Carbon Steels (Case-hardening grades)

Although the majority of the applications of these steels involve carburizing and quenching by one of several methods, some are also used after direct quenching and tempering. Hardness may readily be reduced by annealing, to permit easier machining, and after quenching and tempering the steels will reveal excellent combinations of strength, toughness and ductility.

Of the straight nickel, low-carbon steels, SAE 2315 is characterized by excellent wear and fatigue resistance in the case combined with high core strength. For many applications, a feature is the relatively low quenching temperature that can be used with the corresponding reduction of distortion and scaling. This steel is widely used in pistons, pins, oil pump gears and accessory drive gears, while at least one experimental engine employs it in a variety of parts including wrist pins, cam roller pins, tappets and cam pinions.

SAE 2512, with 5% nickel, is especially useful for applications requiring close to the ultimate in wear and fatigue resistance, with good machinability. It is characterized by a high core strength and, like SAE 2315, by a relatively low quenching temperature. Its many applications include cam rings, knuckle pins, cam and oil pump drive gears, cam shafts, and crankshaft gears. Similar, though not identical steels are being used in aircraft Diesel engine crankshafts. Continental's new 2-cycle radial Diesel employs this steel in its blower gears, water pump and reduction gears, and sleeve drive cranks and gears. The toughness of SAE 2512 is reflected in its machining properties, which are not quite so good as those of the nickel-molybdenum steels or SAE 2315, but ordinarily the steel is quite satisfactory in this respect.



Nickel steel hub for a controllable-pitch metal propeller

SAE steel 3115 (or 3120) is the carburizing grade of one of the low cost nickel-chromium steels. It machines readily and when properly made meets requirements that do not demand higher alloy contents. With a double treatment after carburizing, for refinement of both case and core, exceedingly hard, wear resistant surfaces with tough cores are obtained. These properties have brought wide application to SAE 3115 in aircraft gear pins, piston pins, push rod ends, rollers, and cam rings and gears. In the Wright Whirlwind and Cyclone engines this steel is used for the inlet and exhaust cam, the operating schedule being as follows: After forging, normalize at 1625-1650° F., machine, copper plate (except gear teeth and cam), carburize at 1650-1675° F., cool in the pot, harden and test depth of case, drill holes, heat to 1400° F., quench in oil, temper at 350-375° F., grind and test the hardness.

Other nickel alloy steels of the carburizing grade that are used to some extent include SAE 2320 (of similar application to SAE 2315) and SAE 4615 (carbon .15%, nickel 1.80%, molybdenum .25%). The latter, because of its good machining properties has been popular in other fields, notably in automatic machine production. Recently it is being applied to aircraft engine construction, especially for Diesel knuckle pins, rod bushings (for needle bearings), roller bearings and miscellaneous small wear resistant parts. SAE 4615 will provide file-hard cases on oil quenching, with almost as high core strength as SAE 2315.

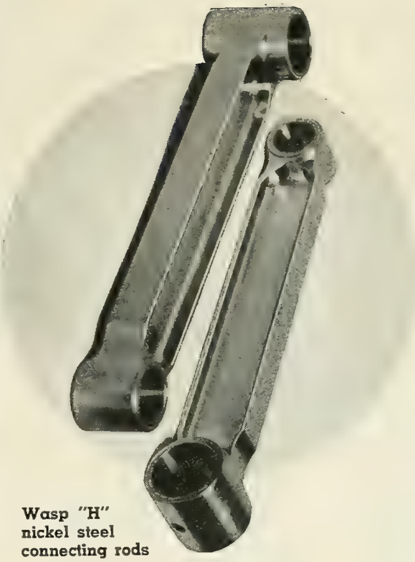
Oil and Water Hardening Steels

Steels with less than about .30 to .35% carbon are water hardening in sizes between ¾" and 2½"; those with higher carbon contents are oil hardening. Choice of the quenching medium, however, depends also on alloy content, and size and shape of the pieces. Steels with the highest proportions of alloying elements, such as the SAE 3300 series (3.50% Ni, 1.50% Cr) are generally oil quenched even in the low carbon grades. Steels with intermediate proportions of alloying elements and higher carbon contents, e.g. SAE 2330, are sometimes water quenched in both small and moderately large sections (1 to 4 inches in diameter). On the other hand, parts of SAE 2330 that have sharp corners or large changes in section from one area to another are best oil-hardened, to avoid the danger of distortion and cracking.

SAE 2330, a straight nickel steel, is employed in parts subjected to torsional and "fatigue" stresses, such as propeller shaft tubes, fuel and oil pump shafts, valve rockers, and miscellaneous studs and bolts. It is characterized by a combination of good strength and great toughness.

Desirable qualities imparted to steel by the combination of nickel and chromium are available at low cost in SAE 3140. This steel, because of creep resistance up to 1000° F. (far superior to unalloyed steels of similar carbon content) is useful in valves and fittings for high temperature service. In addition its elastic properties and strength have brought application in crankshafts, magneto and tachometer drive gears, tappets, rocker arms, studs, nuts and washers, and master rods. It is most useful in parts of less than 2" section, in which the strength required permits tempering at high temperatures, with the resulting development of high impact and fatigue resistance along with good elastic properties.

A much higher alloyed steel, and therefore more expensive, is SAE 3340, the total nickel and chromium content of which is about 5%. Its mechanical properties, however, are superior to those of the lower nickel-chromium steels, especially in heavy sections. SAE 3340 is extensively applied in various heat treated forgings that are usually tempered at relatively high temperatures after hardening. Among its established uses in aircraft engines are magneto and oil pump gears, propeller hub cones, accessory drive shafts and starter gears, in which the developed combination of fatigue resistance and ductility is most valuable in resisting occasional overstressing from vibration or other causes.


Wasp "H" nickel steel connecting rods

Increasing in aircraft engine application is SAE steel 4345, a nickel-chromium-molybdenum steel. The combination possesses excellent depth hardening properties and is therefore most suitable for large sections where strength and hardness must be the equal of those obtained in small sections with other steels. The use of this steel is not confined to the larger sizes, however, for its good impact resistance at high strength and machinability at high hardness are useful in any section. In aircraft engine construction, SAE 4345 is used in crankshafts and connecting rods, spiders, and Diesel knuckle pins.

While this discussion hardly exhausts the list of nickel alloy steels used in aircraft engines, it does present the properties and established applications of those most widely used. The choice of a steel for a given application is dependent on the performance and properties desired. Frequently more than one of the commercial nickel alloy steels will meet a particular set of strength, ductility and impact test requirements. Selection then depends on economic considerations, in which the price per pound of the steel is balanced against fabrication, machining and treatment costs, the ease of reproductibility and the spoilage or risks in the required processing technique. In other words, where some interchangeability in performance or property requirement satisfaction exists, the selection of a steel should be based largely on the cost of the finished parts.

Other Nickel Alloys

Monel Metal, an alloy of 70% nickel and 30% copper, possesses some interesting applications in aircraft engines. Diesel oil filter rings are often made of this metal. A recent development in safety devices is a fuel level signal which warns the pilot of any interruption in the flow of fuel from tank to pump. The dependability and automatic operation of this instrument depends in no small measure on the use of Monel Metal in all parts subject to corrosive or erosive attack, e.g. studs, valves and float guides. One company uses Monel Metal rivets to attach the circular boom members of a wing spar to the central web.

The well-known austenitic stainless steel containing 18%Cr and 8%Ni is used in various corrosion resisting capacities throughout the entire plane, e.g. in floats, wing frames, and for main beam assembly to maintain the strength of small parts. In France's *Lieutenant de Vaisseau Paris,* parts of the control equipment located near the compass were made of a similar austenitic chromium-nickel steel, because of its non-magnetic properties.

Inconel, an alloy containing 80% Ni, 14% Cr and 6% Fe has found an inter-

(*Continued on page* 110)

Nickel Alloy Steels Used In Aircraft Power Plant

Parts	Mechanical Requirements	Steel Used		
		Designation	Approx. Composition %	Treatment
piston pins, oil pump gears, accessory drive gears	High Wear and Fatigue Resistance in Case; High Core Strength	SAE 2315	.15C 3.50Ni	Carburized and hardened
fuel and oil pump shafts, valve rockers, bolts	Strength and Toughness; Subjected to Torsional and Fatigue Stresses.	SAE 2330	.30C 3.50Ni	Oil or water quenched from 1450°F.; tempered 900-1000°F.
cam rings, knuckle pins, cam and oil pump drive gears, cam shafts, crankshaft gears, Diesel crankshafts.	Good Machining; Superior Wear and Fatigue Resistance in Case; Great Core Strength; Low Quenching Temp. to Minimize Distortion	SAE 2512	.12C 5.0Ni	Carburized and hardened
gear pins, piston pins, push rod ends, valve tappet rollers, cam rings, cam gears, Diesel wrist pins	Small Parts of Exceedingly High Surface Hardness and Tough, Shock-Resisting Core.	SAE 3115	.15C 1.25Ni .60Cr	Carburized and hardened (double treatment)
studs and nuts, washers, master rods, crankshafts, oil pump drive gears, magneto and tachometer drive gears, tappets, rocker arms	Creep Resistance; Higher Elastic Properties, Good Wear Resistance; Toughness	SAE 3140	.40C 1.25Ni .60Cr	Oil quenched from 1500°F.; tempered 900-1200°F.
magneto and oil pump gears, propeller hub cones, accessory drive shafts and starter gears	Fatigue Resistance; High Strength Combined with Ductility	SAE 3340	.40C 3.50Ni 1.50Cr	Oil quenched from 1425°F.; tempered 900-1000°F.
crankshafts and connecting rods, spiders; Diesel knuckle pins	Depth Hardening for large sizes; Impact Resistance; Machinability at High Hardness	SAE 4345	.45C 1.75Ni .65Cr .35Mo	Oil quenched from 1500°F.; tempered 800-1000°F.

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Aircraft Finishing

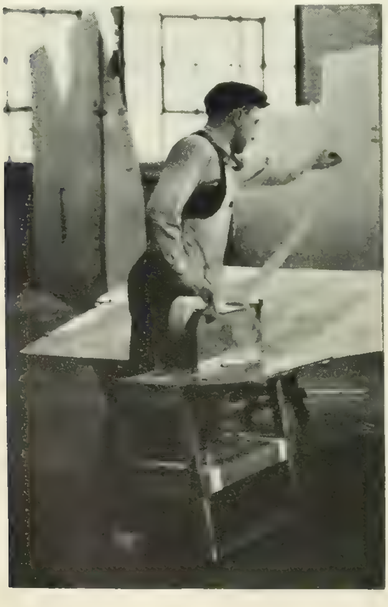
G. H. ROBERTSON

The Sherwin-Williams Co.

In the course of aviation's progress vast strides have been made in the development of suitable finishes for fabric-covered planes and recently, in metal finishes, and a considerable measure of this progress can be attributed to the development of the newer types of finishing materials and improved techniques in application. This is true especially in the case of the fabric finishes, and it has been in the construction of fabric-covered ships that earlier major developments were made and by which method practically all but some of the latest types of transport planes and some few of the Army and Navy planes are still being built.

● Not only are aircraft finishes of a specialized type—the technique of applying them is unique. This is particularly true of the fabric finishes, and since so much depends upon the success of these finishes, some discussion of the methods of applying them and the nature, cause and remedy for common airplane finishing troubles should enable the finisher to obtain maximum durability, protection and good appearance, and to avoid the too frequent and costly finish failures.

Four factors determine the success of the job. They are: suitable materials, proper application, satisfactory equipment for handling the materials and adequate control of both temperature and humidity. Cellulose nitrate dopes are being used almost exclusively in the United States for fabrics at the present time. They are less expensive than the acetate type, non-toxic, easier to apply, durable, less subject to ring-worm or cracking, produce a high degree of tautness that is not affected detrimentally by moisture and will produce a built-up, high gloss finish.



Applying doped tape to wet surface

Actual finishing systems may be divided into three major types: (1) the pigmented dope—commercial type; (2) pigmented dope—military type; and (3) the semi-pigmented dope type.

The commercial system calls for two brush coats of clear nitrate dope, the first thinned slightly to insure greater penetration. Taping is applied simultaneously with the second coat of dope. Light sanding should be done with fine paper after at least ½ hour drying. The third and fourth coats may be brushed or sprayed. There are special pressure feed spray guns which permit applying these dopes full-bodied, or they may be thinned with at least equal parts of thinner and applied using a suction cup type spray unit. More coats will be required, however, to obtain the same build. After sanding the fourth coat, two or three spray coats of aluminum pigmented dope are applied, according to the amount of reduction. Cross spraying is preferable and at least three hours drying should be allowed before sanding with No. 220 carborundum type paper. This operation is followed by three cross-coats of pigmented dope in the desired color. The first two coats are thinned slightly and water sanded after at least one hour drying. The final coat is polished to give a smooth, resistant surface.

The military system is much lighter, less costly and gives excellent service although it does not produce the smoothness and built-up finish of the commercial type. The principal difference is the omission of the aluminum coats. The procedure of application of the semi-pigmented dope system is essentially the same as with the other systems except that semi-pigmented dope is used, and brush application may be substituted throughout These dopes comprise approximately equal parts of clear and pigmented dope

Although good grades of cellulose nitrate dopes apply more easily than former types, various difficulties in obtaining a perfect finish may result from adverse atmospheric conditions, poor spraying equipment or poor technique in handling the materials, including surface preparation, brushing, thinning, spraying drying and sanding.

Wherever the volume of painting makes it practicable, the use of jigs cradles or mono-rail suspensions will save time and facilitate handling fuselages, wings and other parts. In recovering ships it is important that the humidity be low to avoid subsequent slackening o the fabric. By applying at least one coa of dope the same day the fabric is applied, variations in tautness of the cove due to changes of temperature and humidity are avoided.

Dopes as manufactured, possess a viscosity suitable for application within wide temperature limits but work best around 60° to 90° F., with a relative humidity

(*Continued on page* 45)

KNOWING HOW

. . is the key to aircraft progress

uring recent weeks, in the Northwest, in southern California, in the East, in ties here, there, everywhere . . . new Aviation projects have been started. Again XPERIENCE goes into action . . . again the industry is calling upon its allied anufacturers for co-operation . . . and getting it!

Today's greater speed, safety and comfort are the products of men who "KNOW OW." Every part of the ships themselves and every detail of the extensive Ground Aids" are the result of specialized knowledge in each particular field.

The diversified activities of Aviation are closely interlocked. Airport buildings re not just buildings. They have become mammoth service institutions, skillfully esigned and engineered to house the innumerable activities which are vitally nked with the industry.

The designing, engineering and construction of Airports, aircraft factories and angars not only calls for experience in building but a knowledge of the specialized emands of the Aviation industry. Austin executives consider one as important as ne other . . . have prepared themselves, through long-time activity in the field . . . to ffer both. Offices from coast to coast, permit convenient meetings for consultation.

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Structural Steel Shapes	*by Carnegie*
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Boilers	*by Babcock & Wilcox*
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Glass	*by Pittsburgh Plate*
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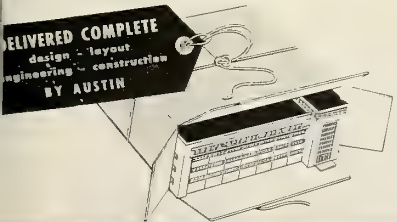

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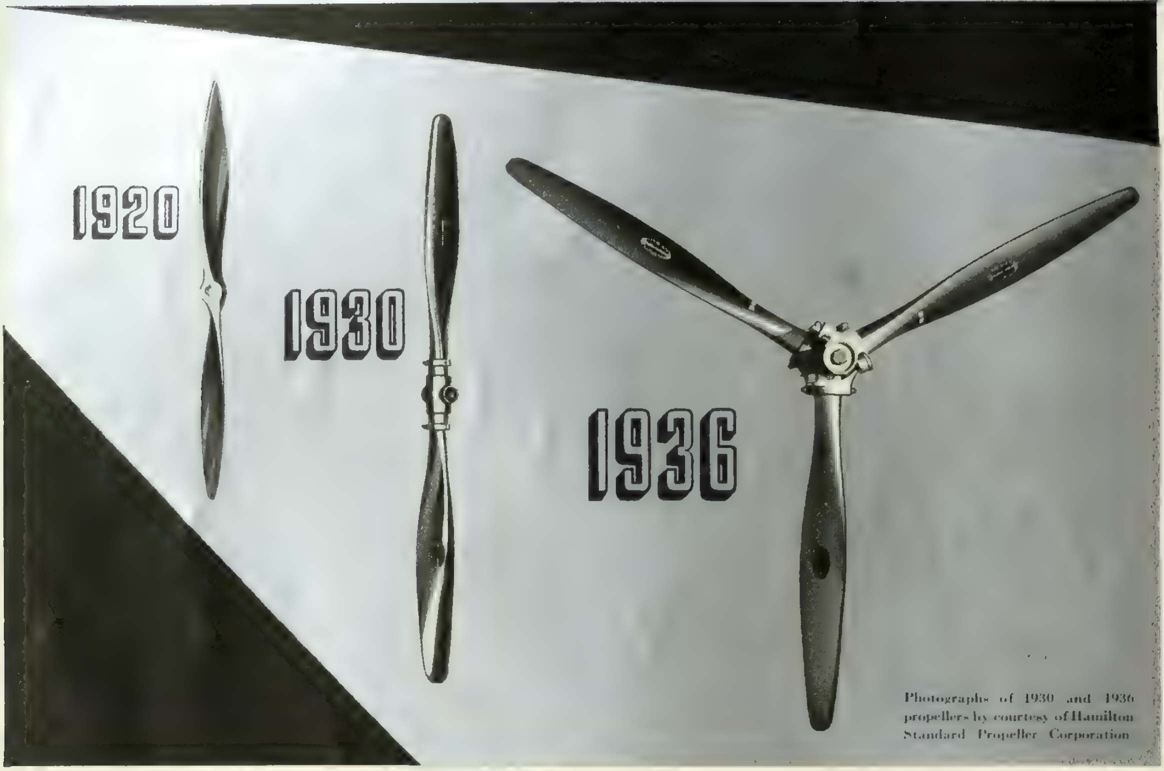


Photographs of 1930 and 1936 propellers by courtesy of Hamilton Standard Propeller Corporation

In 1920 all-metal propellers were simply one-piece forgings of Aluminum.

A decade later the *adjustable* pitch propeller marked advancement.

Today — the *controllable* pitch propeller . . .

• • •

These improvements in functional design are paralleled by greatly increased reliability and useful life. For this progress three factors are chiefly responsible:

(1) Makers of engines have reduced the vibrational stress on the blade.

(2) Propeller manufacturers have made valuable contributions to design.

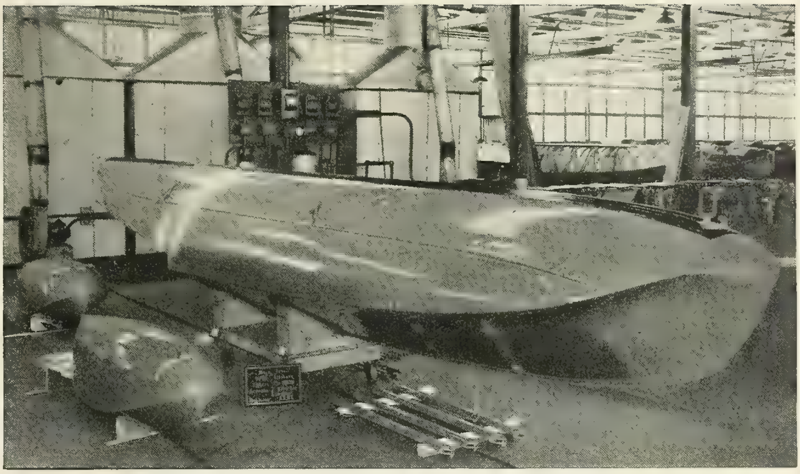
(3) Alcoa Aluminum, from the inception of the metal propeller over 15 years ago, has had a most enviable record as a highly dependable material.

The more exacting requirements brought about by the continual advancement of the industry have been met by progress in working Aluminum. This has been made possible largely through close co-operation with the manufacturers and with the operators. The result: Alcoa Aluminum is today the pre-eminent material. Aluminum propellers are first choice.

This co-operative effort is typical of the way in which our laboratories and shops work on the common problems of aviation advance. The interests of aviation are indeed one with the interests of Alcoa Aluminum. As the industry advances, so will Alcoa Aluminum. ALUMINUM COMPANY OF AMERICA, 2194 Gulf Bldg., Pittsburgh, Pa.

ALCOA ALCOA ALUMINUM ALUMINUM

(*Continued from page* 42)



A newly finished set of floats and struts for a U. S. Navy seaplane

of about 70%. Both temperature and humidity are best controlled by air-conditioning units where it is practicable to install them; otherwise painting schedules must be regulated by existing conditions. During the summer months a frequent problem is that of blushing. This condition results from a cooling of the surface due to too rapid evaporation of the solvents, which causes a condensation of moisture from the air in warm and humid weather. This condensation actually precipitates the nitrocellulose out of solution and leaves a whitish appearance. If the blushing is not removed the finish will quickly fail at such points and there will be no satisfactory tautening or protection of the surface. One safe precaution is to add retarder (or anti-blush) reducer to the regular reducer on humid days. Surface blushing can be removed by spraying a coat of thinner over the affected area. Deep blushing may require light wiping back and forth over the spot with a lint-free cloth saturated with a special anti-blush preparation.

In cold weather, dopes left in unheated rooms will become too viscous, resulting in pulling and roping under the brush. The addition of extra thinner to obtain proper flow will only result in cutting the desired body. If the dopes are placed in a warm room for from 24 to 48 hours before they are to be used, satisfactory consistency is assured. Brush application of the first two coats of dope is recommended because spraying of these coats tends to raise the nap of the fabric excessively, necessitating more drastic sanding.

The most common method of applying reinforcing patches and finishing tape is that in which the surface is doped between adjacent ribs, the tape being doped separately and laid on while both are still wet. Better appearance can be obtained by applying reinforcing patches before taping whenever possible and the dope should be full-bodied to insure maximum adhesive action. Garnet paper is satisfactory for scuffing after the second brush coat of clear dope. In the event any bubbles have been produced by the brushing operation, these must be completely removed, otherwise pinholes will appear in the final finish. Carborundum type papers are the more satisfactory for subsequent sanding operations because of their speed and sharpness. The time saving will offset their added cost.

At least three hours drying should be allowed before sanding the aluminum pigmented dope. More time is desirable. Sufficient drying will make the sanding operation easier and prevent clogging the paper. Failure to adequately sand this coat may result in peeling of the final coats and since the quality and appearance of the final job depends so much upon care in sanding the aluminum and other coats, extra effort in this direction will be rewarded. Aluminum coatings are usually dry sanded, but if water sanding is desirable to avoid dust, care must be taken not to cut too deep. Water sanding of colored coats will be facilitated by adding a small amount of liquid soap to the water. It is important, however, to thoroughly rinse the surface to avoid any residue. Another precaution to take is to electrically ground all surfaces during the sanding operations to prevent fire.

Spraying is recommended to reduce both time and labor but it requires exacting care. The type of gun used and the air pressure determine the amount of thinning necessary. Insufficient thinning as well as incorrect pressure and improper handling of the gun are the usual causes of a pebbly or orange peel effect, streaks and laps. Care must also be taken not to over-thin the material or runs will result. Too heavy coats are the cause of sags and allowing insufficient drying time may cause raising or lifting. Where this condition results it will be necessary to clean down the surface and refinish.

On the matter of refinishing there are three alternatives: (1) recovering and refinishing; (2) refinishing over the old finish; and (3) removing the old finish first. In deciding which procedure to adopt, it is important to carefully examine both the dope and fabric. If the dope shows considerable ring-worming and the fabric has blackened from deterioration, complete recovering and refinishing is the only solution. Where the fabric is in good shape and the finish has broken down only in small areas in the pigmented coat, the ring-worms can be removed by saturating a soft cloth with remover and rubbing the dope in a circular motion. Better bonding to the old finish will be insured by adding about 25% dope remover to the first coat of dope, and this should be applied before the softened area has set. Additional coats should be applied as usual to build up the area.

In refinishing over the old surface it

(*Continued on page* 110)

Wing panels leaving the finishing department and ready for final assembly

Menasco Model C4S and B6S Engines

The four-cylinder inverted "Pirate" engine rated at 150hp and the 6-cylinder 200hp "Buccaneer"

● Commercial production of two new supercharged engines of the inverted in-line type has been inaugurated at the Menasco Manufacturing Co. plant in Los Angeles. One of these is the four-cylinder Pirate model C4S rated 150 hp at 2260 rpm at 3000 ft., and the other is the six-cylinder Buccaneer model B6S rated 200 hp at 2250 rpm at 4500 ft.

Basic features of these engines are similar to other Menasco models which have preceded them. They offer the advantages of the inverted in-line type such as low frontal area, improved streamlining possibilities, reduction of exhaust noise and fumes, improved forward visibility, high propeller thrust line, low center of gravity, and accessibility to engine and parts.

Featuring ruggedness and simple construction, these engines carry their accessories, including the supercharger, in the rear in such a manner as to be readily accessible. Crankcases are ribbed for strength, while the crankshaft is carried on five main bearings in the four-cylinder model and seven in the six-cylinder engine with a ball thrust bearing in either case to locate the shaft against thrust.

Main and connecting rod bearings are of standard babbitt metal type. Pistons are the full skirt waffle head type with underhead cross ribbing for added strength and heat dissipation. Piston pins float in both the connecting rod and piston and are located by end buttons.

Nickel iron cylinders are standard on both engines, although steel cylinders may be obtained where lighter weight is desired. Separable heads are held to the cylinder and through to the crankcase by long nickel steel studs to provide easy servicing as any cylinder head may be detached by removing four nuts and disconnecting the intake manifold. Heads are of Menasco cast aluminum alloy with one intake and one exhaust valve per head spread laterally to provide ample cooling area over the head itself and with generous finning for efficient cooling.

The crankshaft has a splined propeller hub end of the No. 10 SAE type. Standard SAE mounting flanges are incorporated in the accessory case for mounting the generator and starter. Magneto ignition is standard, but battery ignition can be supplied if desired.

Aluminum castings throughout the engines are of Menasco foundry production, and the superchargers are also of Menasco design and manufacture. Both engines incorporate a special type cushion in the supercharger gear train which permits direct drive without provision of a slip clutch, and supercharging has been made more efficient due to the exposed supercharger scroll and long intake manifold which together provide an intercooler effect. This cools the compressed charge and allows the use of high manifold pressures without excessive heating.

Although construction of the crankcase is similar for both engines, the four-cylinder unit is split on the center line of the crankshaft and major stresses are carried through the lower case, the upper case serving as a cover. In the six-cylinder model, the crankcase is of the one-piece type with a cast Dowmetal cover plate, finned both internally and externally for strength and cooling. Engine mounting ledge is cast integral with the case on the B6S engine, although the C4S engine uses four separable cast aluminum mounting legs. The crankshaft is Wyman-Gordon chrome nickel steel SAE 3240 of one-piece construction in both cases.

Without the air scoop, fuel pump or propeller hub, the C4S weighs 305 lbs., and the B6S, 415 lbs. Fuel consumption for both engines is .56 lb./hp/hr while oil consumption for the smaller horsepowered engine is .010 lb./hp/hr and .018 lb./hp/hr for the 200 hp model. Ignition for the C4S is supplied by two Robert Bosch, or Edison-Splitdorf, while only

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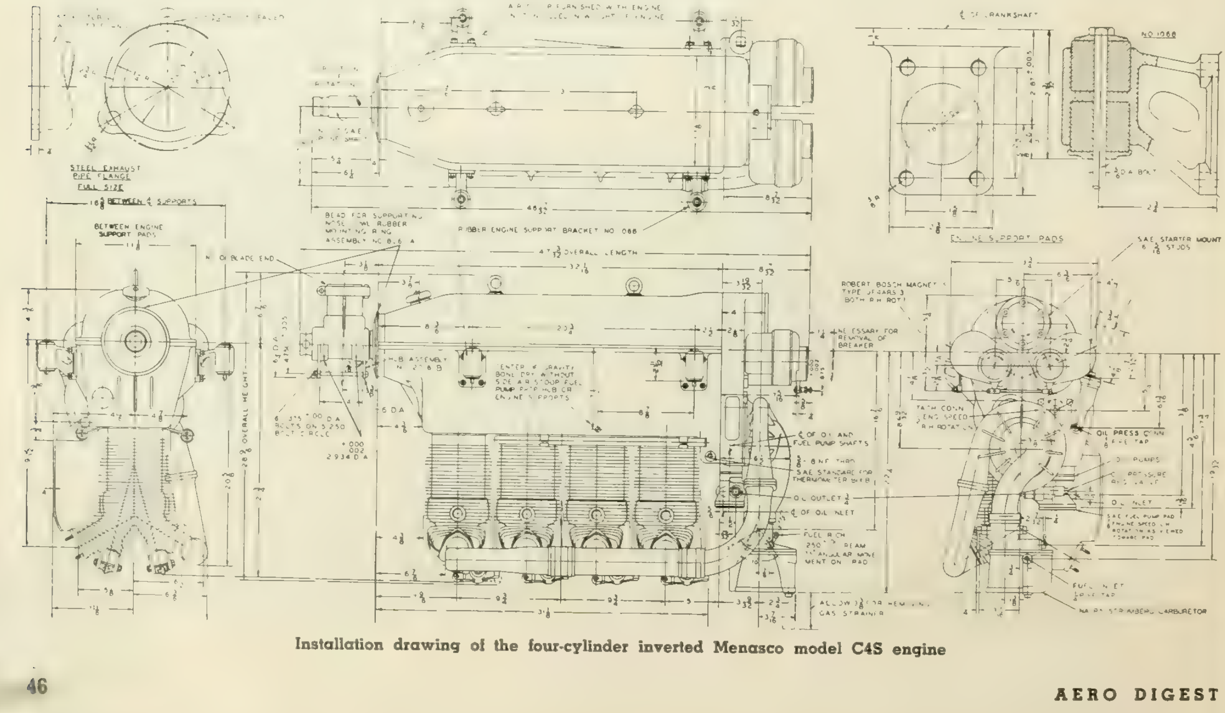
STEEL EXHAUST PIPE FLANGE FULL SIZE
BETWEEN ENGINE SUPPORT PADS
RUBBER ENGINE SUPPORT BRACKET NO 088
OVERALL LENGTH
ENGINE SUPPORT PADS
SAE STARTER MOUNT
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Installation drawing of the four-cylinder inverted Menasco model C4S engine

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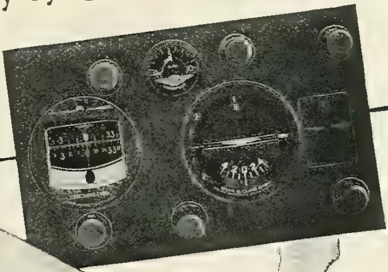
Always in the front rank of pioneering development United Air Lines have been using Gyro-Horizons and Directional Gyros as standard equipment since these instruments were introduced to aviation more than six years ago.

To provide smooth, automatically controlled flight they are equipping their new fleet of 24-passenger Douglas transports with the most effective combination of these two important gyroscopic instruments —the Sperry Gyropilot.



Seventeen of the World's Leading Airlines are flying 50,000 miles per day by Sperry Gyropilot.

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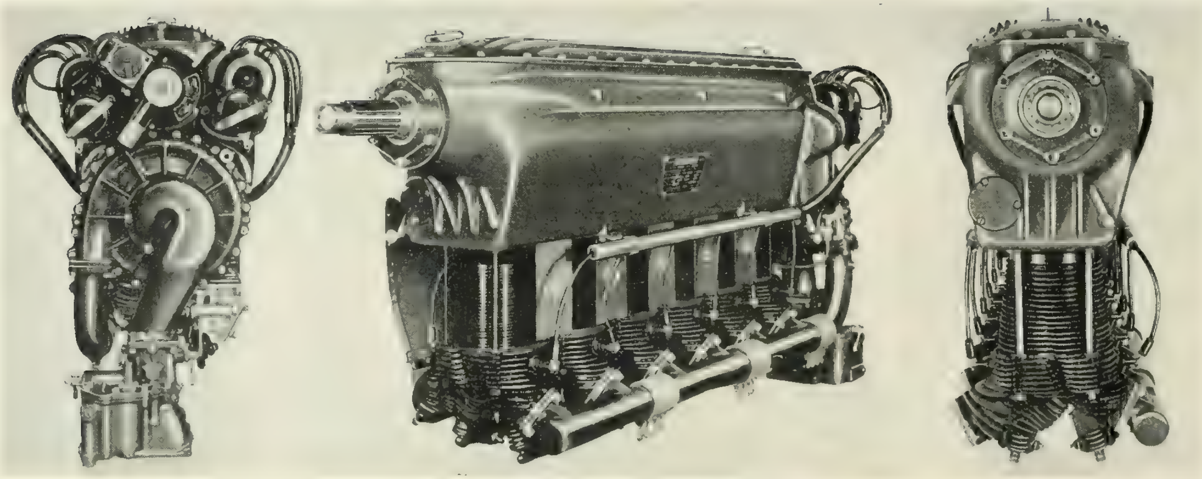

The Model B6S six-cylinder Menasco engine

(*Continued from preceding page*)

the former are standard on the B6S. Equipment furnished with both engines includes a side air scoop, lifting eye bolts, tool kit, steel exhaust flanges, propeller hub cones and nut. Mounting supports are supplied with the C4S only. Extra equipment furnished on order includes an electric or hand starter, fuel pump, hub for wooden propeller, battery ignition, and an electric generator.

The unsupercharged models B4 and C4 four-cylinder engines of 95 and 125 hp respectively, of which the C4S and B6S are a development, have been used commercially in Waco, Fairchild, Ryan and other types. In racing circles they have since 1931 won all official events in their power class. The American air racing championship for 1934 was awarded to Lee Miles for his flying with the C4S Pirate-powered Miles and Atwood Special. For 1935, the award was made to Harold Neumann who won the Greve Trophy Race for 550 cu.in. displacement aircraft at the National Air Races with his Menasco B6S-powered Howard racer *Mike*. Both of these engines were of standard commercial type with practically no special features to increase performance for racing purposes other than that they were operated at higher than recommended commercial rpm.

The Model B6S Buccaneer, prior to its commercial introduction, powered the Polish P.Z.L. monoplane that finished first in the 1934 Challenge Tourisme Race. While this plane did not win the sweepstakes event (which is based on technical considerations other than speed), its performance and that of the engine from a speed and endurance standpoint over the course were noteworthy.

This engine is also used in Australia by the Tugan Aircraft Co., in their Australian-built *Gannet* monoplane (formerly the *Codock*). Also in connection with the recent sale of the manufacturing rights for current models of Menasco engines to Phillips & Powis Aircraft Ltd., of Reading, England, it is understood that the Model B6S will be offered as optional

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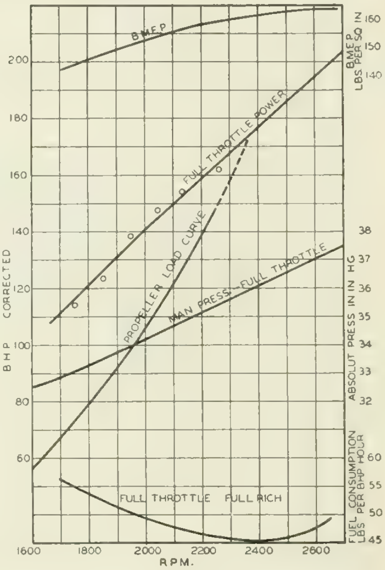
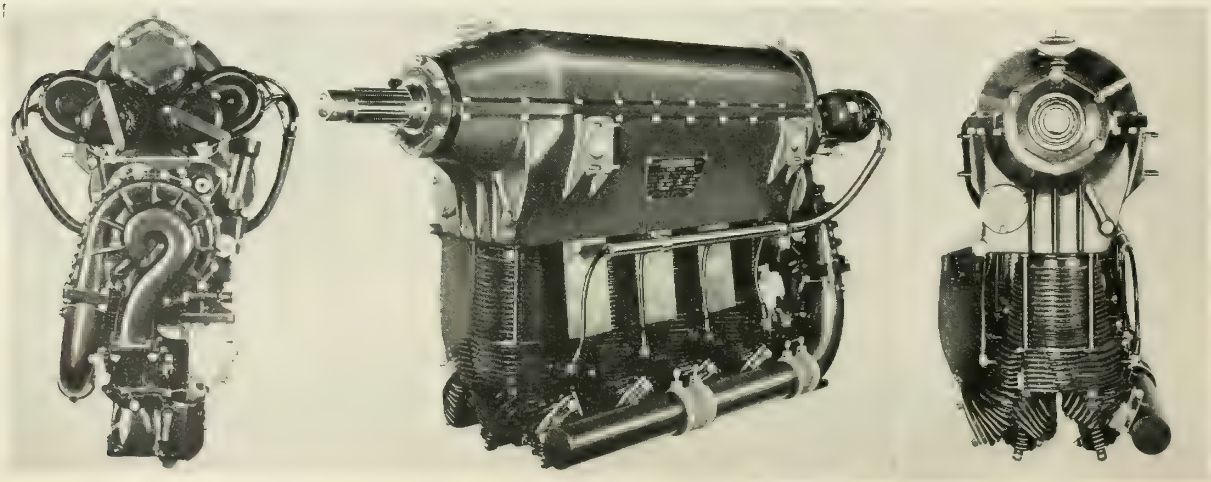


Performance curves and (below) views of the four-cylinder Menasco Model C4S engine



Announcing—a new 1936 Westinghouse Transmitter

RELIABLE...COMPACT...LIGHT WEIGHT

The Westinghouse Electric & Manufacturing Company now celebrating its Golden Jubilee, after a careful investigation of what pilots wanted in a radio transmitter, is happy to announce its latest achievement—a 100% modulated, 20 watt aircraft telephone transmitter which operates from a standard 12 volt battery.

✓ *Check these features*

LIGHT WEIGHT—One of the lightest sets completely installed per watt output. Minimum deduction for pay load.

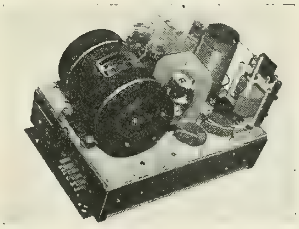
POWER OUTPUT—20 watts, giving unusual range.

INEXPENSIVE TUBES—Readily obtained in any radio store.

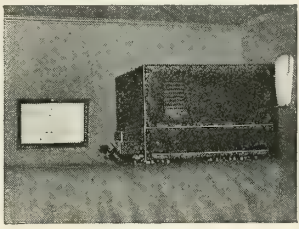
ECONOMICAL—Low battery drain.

SIDE TONE.

EASILY INSTALLED—Needs only one cable and plug to connect with remote control. Small installation charge because of simplicity. No expert needed for installation.



Compact—single unit construction. Dynamotor built in.



Actual installation.

TWO OPERATING FREQUENCIES—3105 kc., 3120 kc.

COMPACT—Single unit construction, dynamotor built in. Measures 12¾″ long, 8″ high, 8¼″ wide.

REMOTE CONTROL HEAD in a standard aircraft instrument case.

ANTENNAE CURRENT INDICATED ON INSTRUMENT PANEL—luminous dial.

LORD SHOCK PROOF MOUNTING—adds long life to tubes.

ANY LENGTH REMOTE CONTROL—Set may be mounted in most convenient place.

INSTANTANEOUS OPERATION—Made possible by quick heat tubes.

EASILY SERVICED—Convenient test jacks. Removable as a unit.

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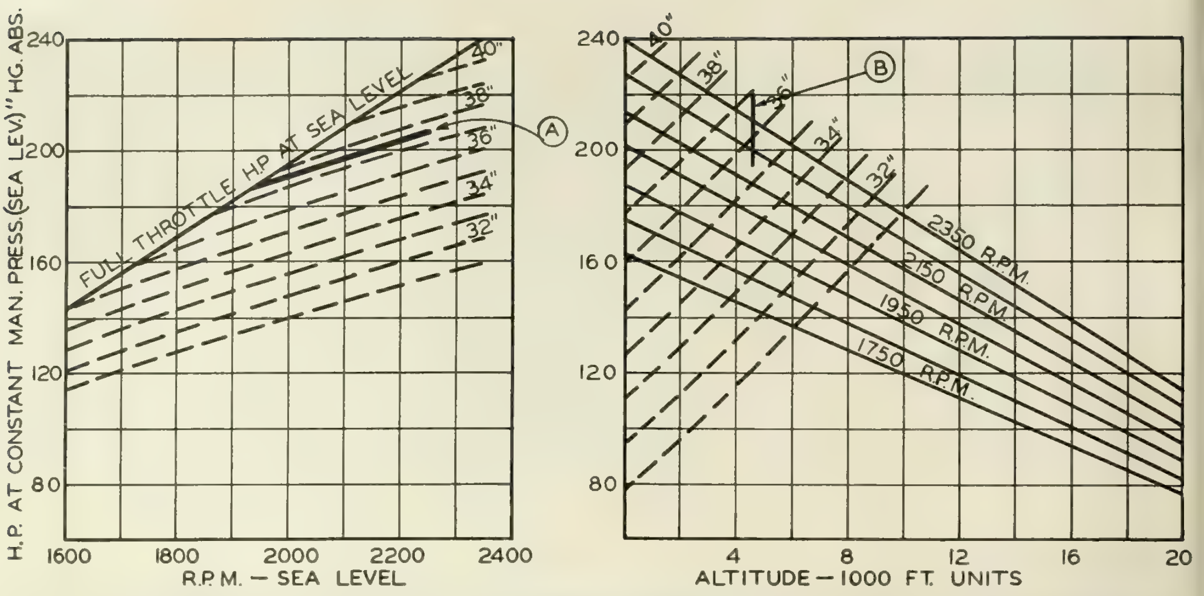


Altitude performance curves of the Menasco B6S Buccaneer engine superchanged 8:75 to 1. A = hp available for take-off (manifold pressure 37.5" Hg. abs. allowable for one minute). B = critical altitude 4600 ft. 200 hp at 2250 rpm. (manifold pressure 35.8" Hg. abs.)

(Continued from preceding page) equipment in the new Miles *Peregrine* which is being introduced shortly.

The C4S and B6S have been flight tested throughout the United States in such commercial airplanes as the twin-engined Allan Lockheed *Alcor* monoplane and the *Crusader* which is powered by two C4S engines. This latter engine is also offered as optional equipment by the Ryan Aeronautical Co. in their model S-T, and Neumann and S. J. Wittman are each now building new racers which are being powered with this engine.

Both engines hold approved type certificates, the C4S having No. 134, and the B6S, No. 139. Their specifications are as shown in the adjoining column.

	Model C4S	Model B6S
Bore	4.75 in.	4.50 in.
Stroke	5.125 in.	5.125 in.
Displacement	363 cu. in.	489 cu. in.
Compression ratio ...	5.5 :1	5.5 :1
Supercharger ratio ..	9.6 :1	8.75 :1
Horsepower	150	200
RPM	2260	2250
Altitude	3000 ft.	4500 ft.

The New Ryan S-T for 1936

● Ryan Aeronautical Co. is presenting for 1936 a New Ryan S-T series showing numerous refinements in design and improvements in performance. Three models are available, and all are being manufactured under approved type certificates 541 and 571. The Standard S-T is equipped with the 95 hp (1975 rpm) Menasco B4 engine, the S-T-A with the 125 hp (2175 rpm) Menasco C4, and the S-T-A Special with the 150 hp (2260 rpm) Menasco C4S supercharged engine.

The 150 hp series is the latest addition to the line, and due to its supercharged engine (described in more detail in another article in this issue), offers a rate of climb of approximately 1000 ft./min. at more than 10,000 ft., and a cruising speed of 138 mph at 2000 ft.

Ryan S-Ts have always been equipped with full flaps, but an added feature on the new series is an improved flap control. A direct acting lever on the right side of the cockpit provides almost instantaneous adjustment to any one of three positions, the control allowing the flap to be applied and released in the same manner as a brake is used on an automobile. With the former crank mechanism eliminated, the floor is clear.

A new tail wheel swivel lock has been provided as optional equipment. This device is controlled from the cockpit by a 3-in. lever at the base of the stick. In the locked position, the wheel is held rigidly in line, virtually eliminating the possibility of ground looping in cross winds or other adverse conditions.

Another optional feature is an auxiliary

(Continued on following page)

Front view of the Ryan S-T powered by the 95 horsepower Menasco B4 inverted in-line engine

Timken Bearings have brought improved operation, greater dependability and longer life to radial engine rocker arms by (1) reducing friction and wear to the vanishing point; (2) carrying both radial and thrust loads without the use of thrust washers or other auxiliary devices; (3) preventing harmful lateral movement of the rocker arm under all operating conditions; (4) simplifying lubrication.

The superiority and economy of Timken Rocker Arm Bearings have been proved by thousands of flying hours of service on world-famous transport lines. It will pay you to see that you have them in your engines.

Timken-equipped landing and tail wheels are standard equipment on all the leading makes of airplanes—all types and sizes.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER **BEARINGS**

(*Continued from preceding page*)

fuel tank which can be placed in the front cockpit instead of a passenger without affecting the plane's total weight or balance. This tank can be installed or removed quickly, and when used allows more baggage space. For use with this installation, a removable cockpit cover which hinges open for baggage is available. The installation of the additional fuel tank increases range from 400 to 650 miles.

Engine cowling, fillets, fairing, pants, and almost every part formerly made of aluminum are now made of 17-ST and 24-ST Alcald, giving stronger and more durable parts. Among other improvements in the new series is an improved engine baffling which has lowered cylinder head and oil temperatures. A new fuel tank construction incorporates twice the normal number of baffles, reducing surging and increasing strength and durability, and an improvement in the fuel gauge increases floation and eliminates any tendency to stick or bind.

Performance is enhanced by the use of a new propeller design. The propeller on the S-T, and S-T-A has a diameter of 77 in., while an 80-in. diameter propeller is used on the S-T-A Special. Propeller clearance level is 23.75 and 22.25 ins. respectively, and the ground angle is12° 38′.

The Ryan fuselage has thick gauge Alclad skin which eliminates internal stiffeners and provides strong and durable construction and aerodynamically clean lines. It is elliptical in cross-section, giving good visibility from either cockpit.

Pilot and passenger cockpits are equipped with metal seats designed for seat type parachutes or Kapok-filled cushions. Seat backs are upholstered and pilot's cockpit is now longer and equipped with a form fitting seat back. Upholstering is red leatherette. A 40-lb. baggage compartment equipped with a Sesame combination lock, and of 2.5 cu. ft. capacity, is located between the cockpits, almost over the center of gravity, with the back of the front seat hinging forward as door.

Dual controls are standard with front cockpit controls quickly removable. A torque tube mounted in aluminum alloy bearings connects the two sticks for aileron control and a push-pull tube inside the torque tube provides the elevator connection. Brake pedals, heel operated, are mounted on both sets of rudder pedals.

Aluminum alloy ribs, steel compression members and spruce spars with fabric covering are used in the Ryan wing which is an NACA 2412 section with a 3° incidence, and a 4° 30′ dihedral. The nose of the wing is covered with 17-ST aluminum alloy carried well back of the front spar, giving a true contour of the airfoil, and fittings are oversized and designed to eliminate eccentricities. Either front or rear spar may be replaced without damage to any rib or fitting.

Aileron construction incorporates a steel tube spar with aluminum alloy ribs, and ailerons are balanced by locating the hinges behind the leading edge, which is covered with 17-ST alloy. Differential action is utilized and ailerons are actuated by a short push-pull tube with ball-bearing connections to a bell crank with flexible cable to control stick arm. No pulleys are used.

Flaps are constructed similarly to the aileron with heavier members throughout. They lower to a 30° angle and are effective in braking action and in increasing lift at low speed. Bracing is by streamlined tie rods and double flying wires and single landing wires are used.

Tail surfaces are built up from aluminum alloy tubes and stamped ribs, covered with fabric. Large hinges are employed with removable bronze bushings. Trimming tabs on both elevators provide for longitudinal balance, and may be operated from either cockpit. Any desired adjustment setting is obtainable.

Landing gear is the treadle type with 18 × 8 × 3 airwheels, mechanical brakes (operated from either cockpit), and long stroke oleo shock absorbers. As illustrated on the front cover of this issue, complete fairing, which may be readily removed for inspection or adjustment, is provided. Moving parts incorporate large bronze bearings that are replaceable, and the oleo cylinder is designed to eliminate possibility of oil leakage.

An 8 in. streamlined pneumatic full swiveling tail wheel is mounted on a trombone type rubber shock absorber. Large bearing blocks are bolted to the fuselage and are replaceable.

The welded steel tube engine mount is bolted to the fuselage and may be easily removed. Rubber mountings are used on the engine and a stainless steel firewall separates the engine compartment from the fuselage.

Specifications and Performances

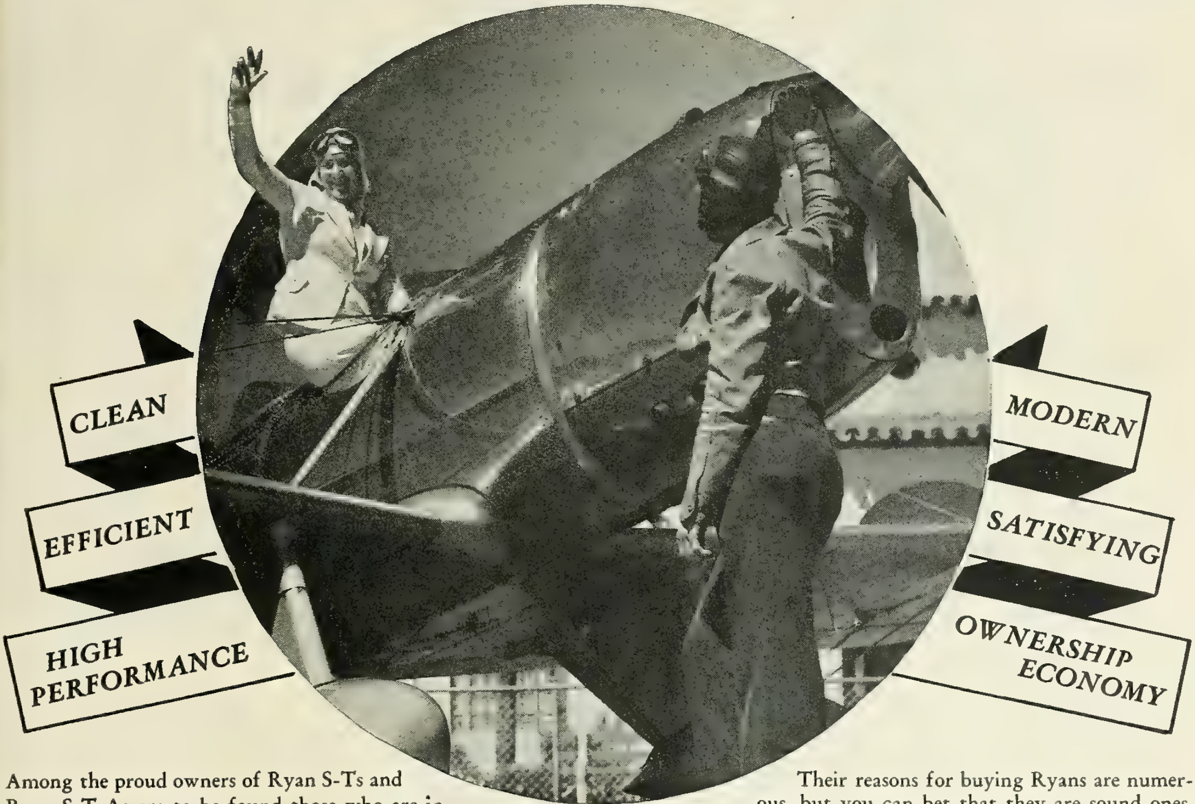
Wing span	29 feet 11 inches
Length overall	21 feet 8 inches
Height overall	6 feet 11 inches
Wing area	124 square feet
Wing loading	12.7 lbs./sq. ft.
Empty weight	1027 pounds
Useful load	539 pounds
Gross weight (max.)	1575 pounds

	Model S-T	Model S-T-A	Model S-T-A Special
Engine—Menasco	B4	C4	C4C
Horsepower	95	125	150
Power loading (lbs./hp)	16.5	12.6	10.5
Max. speed (mph sea level)	140	150	160
Max. speed (mph 7500 ft.)	128	137	148
Cruising speed (mph 2000 ft.)	120	127	138
Landing speed (mph)	42	42	42
Rate of climb (ft./min.)	850	1200	1400
Service ceiling (ft.)	15,500	17,500	21,000
Take-off run (full load, yds.)	190	175	145
Range (miles)	400	375	375

Wing flaps or air brakes can be lowered about 30°

Tabs on elevators eliminate stabilizer adjustment control

The New Ryan S-T Series



Among the proud owners of Ryan S-Ts and Ryan S-T-As are to be found those who are in a position to know airplanes and who can afford planes costing several times the price—yet for their own personal flying they prefer the Ryan S-T and enjoy it the most. The Ryan S-T is a quality small airplane. Its moderate price represents exceptional value.

Here are a few prominent owners: CLIFF DURANT—famous automobile racer and sportsman pilot; CAPT. G. ALLAN HANCOCK—famed Galapagos Island explorer and backer of Sir Kingsford Smith's Southern Cross ocean flights; W. H. IRWIN—Georgian capitalist; PETER DANA—holder of a Junior transcontinental flight record; great-grandson of Richard Dana and Henry Wadsworth Longfellow; BARON JOHN H. VON EYSSENHARDT—sportsman pilot and a former member of von Richthoffen's famous flying squadron; FRANKLIN FARREL, JR.—Chairman of the Board of Farrel-Birmingham Co., New Haven, Connecticut; J. W. THORNE—sportsman racer and youngest driver in the 1936 Memorial Day Classic at Indianapolis; DR. F. M. BOLDRIDGE—Governor of the National Aeronautical Association of North Carolina.

Their reasons for buying Ryans are numerous, but you can bet that they are sound ones. They recognized the Ryan S-T as the answer never before supplied—an airplane supreme in quality, advanced in design, modern in its metal construction, and high in performance.

The Ryan S-T has been called the most beautiful of airplanes, but its pleasing lines are but a hint of its wonderful "fly-ability." It will thrill you with its surge of reserve power, its climb, its speed, and its feature-light-control, plus its great stability and exceptionally slow landing speed.

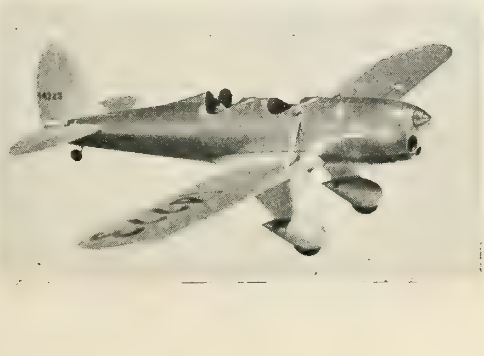
Look at these—Highlights of Performance and Specifications:

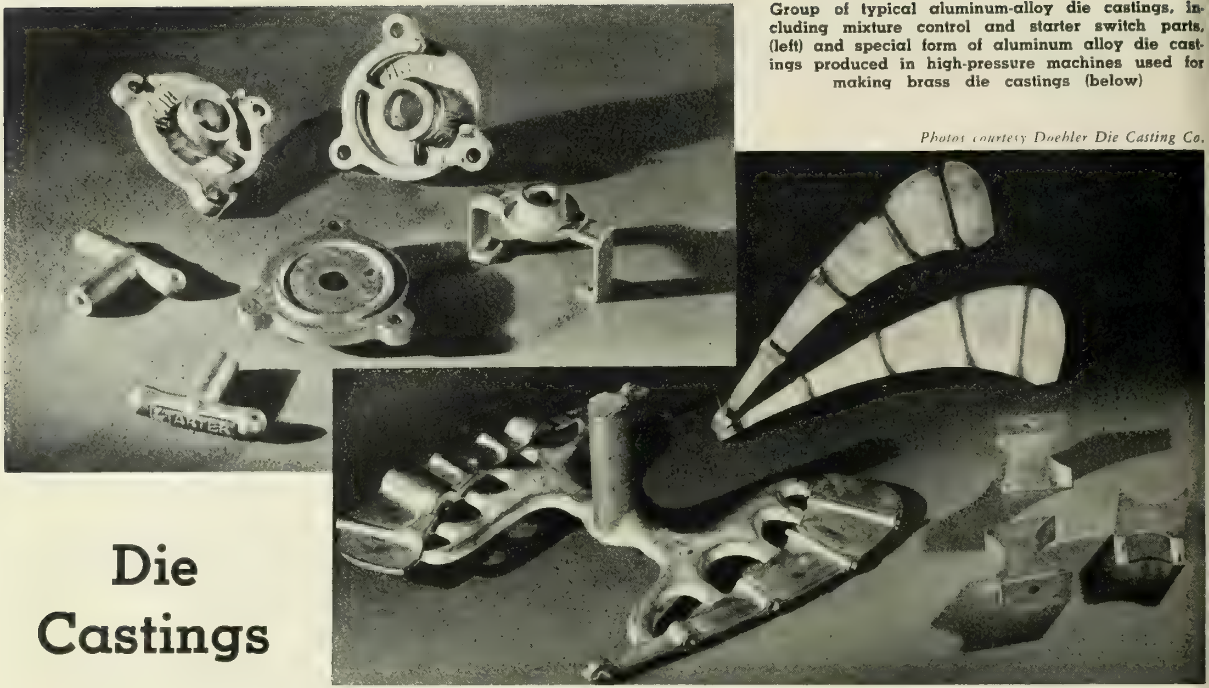
	OPTIONAL MOTOR EQUIPMENT	
	S-T (95 h.p. Menasco)	*S-T-A (125 h.p. Menasco)*
Cruising Speed	120 m.p.h.	125 m.p.h.
High Speed	140 m.p.h.	150 m.p.h.
Rate of Climb	800 ft. per min.	1200 ft. per min.
Landing	40 m.p.h.	40 m.p.h.
Service Ceiling	16,000 ft.	18,000 ft.

Priced $3985.00 up, F. A. F. San Diego, California

RYAN AERONAUTICAL COMPANY

**LINDBERGH FIELD
SAN DIEGO
CALIFORNIA**





Group of typical aluminum-alloy die castings, including mixture control and starter switch parts, (left) and special form of aluminum alloy die castings produced in high-pressure machines used for making brass die castings (below)

Photos courtesy Doehler Die Casting Co.

Die Castings

Alloys for Aircraft Die Castings and their Practical Applications

HERBERT CHASE, M.E.

● Several of the alloys suitable for die casting in the production of parts for aircraft might be still more extensively employed if their advantages were better understood. The use of die castings often necessitates a considerable investment in dies, but there are offsetting considerations, such as dimensional accuracy and comparative freedom from the need for machining castings once they are available, which often justify such investment. Moreover, die manufacture has improved in recent years with resultant decrease in cost, and there are many cases in which die castings can be used advantageously as parts of certain aircraft equipment.

The great advantage of the die casting process is that it makes possible rapid production of castings which are substantially exact duplicates of each other in dimensions and properties and which can be held within rather close dimensional limits so that little or no machining is required. In addition, the surface finish is usually excellent and is often such that only a light buffing is required if plating is desired. When any machining is needed, it is usually a simple operation, such as reaming or tapping holes, which in general are cored to accurate size.

On the other hand, die castings are not entirely free from certain of the disadvantages of sand castings. Thus the aluminum and magnesium-base alloys in particular, do not possess high impact strength and all alloys are subject to a degree of porosity, though this can be brought within required limits and in general can be controlled as to location. In other words, porosity can be confined to sections in which stresses are lowest, hence such porosity as occurs is of little consequence. Compared to sand castings, the advantage of die casting lies chiefly in the lighter sections that are feasible, the greater dimensional accuracy, the ability to core holes of small size, and the much better finish secured. There are, of course, sand castings which cannot be duplicated in die-cast form just as there are die castings which cannot be produced by sand casting.

Chief among the alloys used for aircraft die castings are those in which aluminum is the base metal. This is chiefly because of aluminum's low specific gravity, though dimensional permanence and a fair degree of corrosion resistance are also important considerations. Magnesium alloys are still lighter, but the art of producing them is not so far advanced as with aluminum and some special precautions are required in handling the molten metal. Nevertheless, magnesium alloys are successfullly die cast and some aircraft parts have been made from them in this form.

Alloys having a zinc base are by far the most extensively used of any in the die-casting industry as a whole, but in applications in which light weight is a controlling consideration, the high specific gravity of zinc alloys is a serious handicap, though they have seen limited use in aircraft. They are low in cost, have much higher impact strength than aluminum or magnesium alloys, and are tougher, as well as somewhat more ductile. They are also easier to cast and can be cast in thin sections (less than 0.020 in. in some small parts). This latter fact in some cases can be made to offset, to some extent, their higher specific gravity as compared to aluminum, but the latter can also be cast in thin sections (0.030 to 0.040 in.) in certain instances.

By far the strongest of all die casting alloys are those made with a copper base (brass and bronze), but they are also the most difficult to produce. Since they are comparable in tensile strength to mild annealed steel, however, and have high elongation and high impact strength, they approach more nearly the properties of forgings than do most cast materials. To date, their applications in aircraft are limited, but they present possibilities where most other cast metals are barred for lack of toughness and dimensional accuracy and where forgings cannot be made with economy in complex shapes of required accuracy. Corrosion resistance ranges from good to high, and some forms have good bearing properties. The minimum section thickness for small castings is about 0.050 in. Hardness ranges from 105 to 180 Brinnell, depending largely on the alloy selected, as against 60 to 85 for

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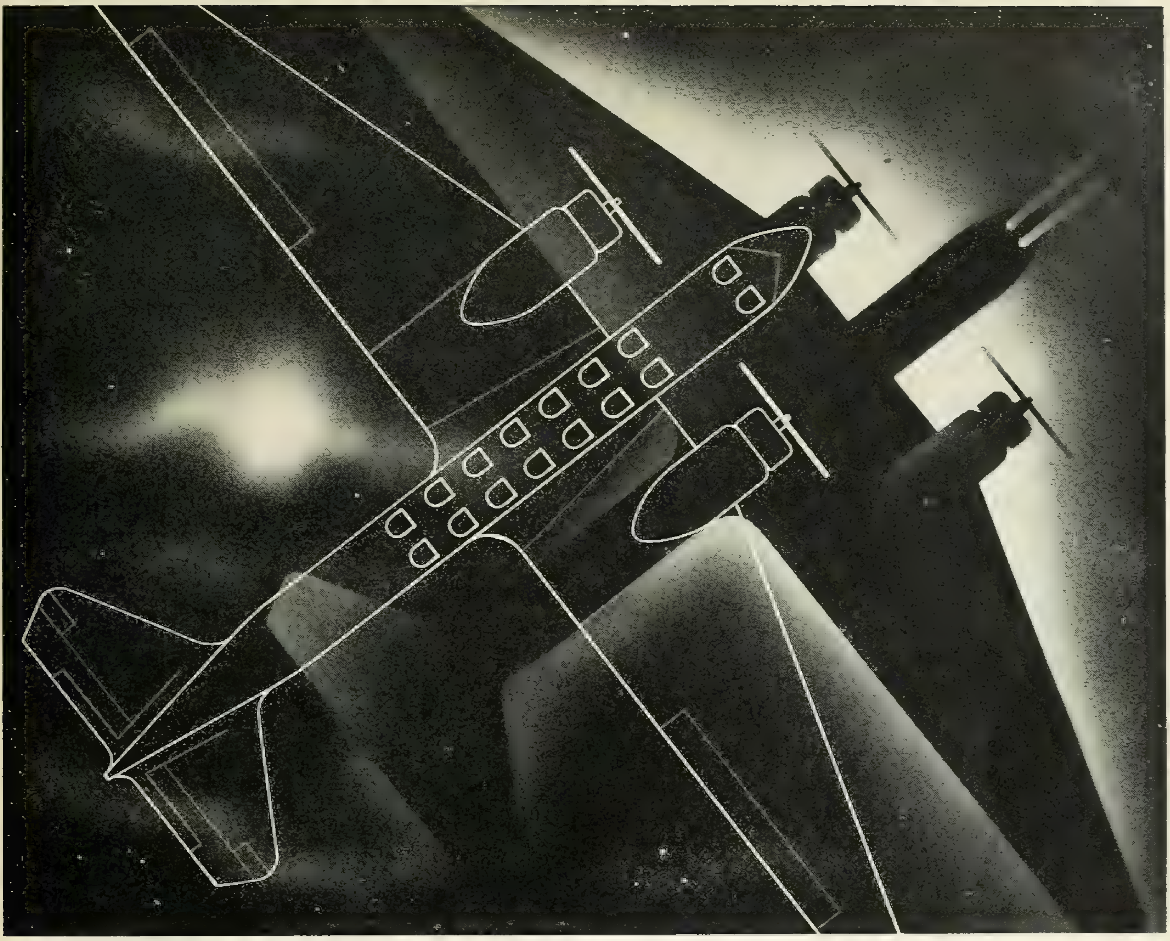

Load Carrying vs. Load Making

The most important requirement for any aircraft material is ability to *carry loads* without *making loads*. It must have strength to stand the rigors of a severe service. It must be light to save every superfluous ounce.

Chrome-Moly steel (SAE 4130X) in forgings, sheath or tubes, meets this requirement perfectly. It is strong, and light. It is also economical to fabricate, whether the process be forging, machining or welding.

Its weldability, and the fact that it does not require subsequent heat treatment is an asset in the construction of large assemblies. It also permits the fabrication of smaller, intricate parts on an economical production basis.

Complete details on aircraft steels are given in two technical booklets, "Molybdenum" and "Aircraft Steels" which will be sent on request. The services of our laboratory are available for ironing out your steel problems. Climax Molybdenum Company, 500 Fifth Ave., New York City.

MOLY

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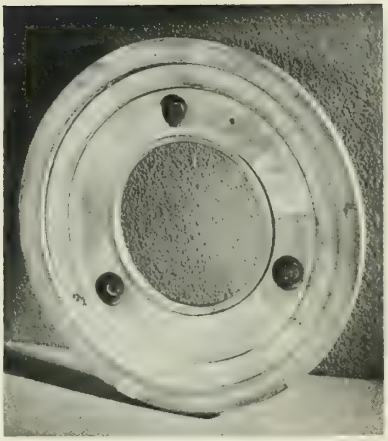
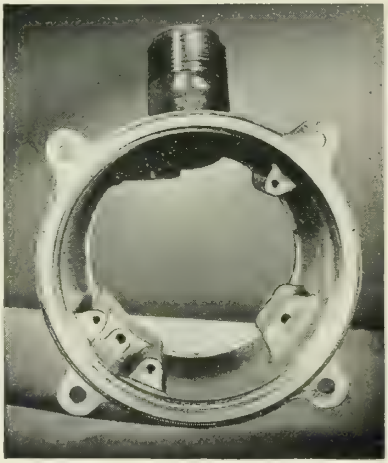
CUTS COSTS

CREATES SALES



Flange die cast from Doehler "Brastil," a copper-zinc-silicon alloy. Below it are shown spark plug radio shield caps from aluminum die castings



The lower illustration shows a tachometer case die-cast from "Doler Brass," a copper-base alloy having 70,000 to 75,000 lbs./sq. in. tensile strength

(Continued from preceding page)

aluminum, magnesium and zinc. Aluminum bronze can be die cast, but is not used extensively because its high melting point results in comparatively short die life.

Most of the important die-casting alloys are covered by standard or tentative SAE and ASTM specifications (except for the brass alloys) and certain alloys are recognized in U.S. Army specifications for aircraft accessories. The latter specifications cover in particular ASTM aluminum-base Alloy No. 7, but add to the specification such items as a minimum tensile strength (for this alloy) of 32,000 p.s.i., a minimum elongation of 2% in 2 in. and permissible dimensional variation of +0.0025 in. per in. for certain parts formed in fixed portions of the die. There are other requirements, one of the most important being the establishment of a minimum weight of casting to avoid the possibility of "freak" castings having, through some fault in the casting process, an excess of porosity.

With die castings, as with many other more or less specialized products, it is highly desirable for best results for the designer and purchaser to work in the closest possible cooperation with the die caster, as the process has certain limitations and if these are not observed the cost of dies and in some instances the proportion of rejected castings may become excessive or at least much higher than need be. In many instances (though probably fewer in aircraft than in other work) when a choice between alloys of the same base metal must be made this is left to the die caster, since he can sometimes produce better results with one standard alloy than with another. Much depends, of course, upon the part to be made and the allowable variation in properties that is permissible. A conference between the die caster and the purchaser before framing exact specifications, however, is likely to benefit both parties and to yield results acceptable to both.

In a brief article it is not feasible to go into all details of alloy selection or even to list all the properties of the several alloys available. The accompanying table and the following suggestions may prove helpful, but consultation with the metallurgist or engineer on the die caster's staff is recommended as tending to benefit all concerned. When government specifications are involved, it is well to consult a caster experienced in meeting the necessary requirements as these are likely to be more exacting than is common in general commercial practice and one who understands the limitations is quite sure to be in the best position to meet them. In conjunction with the use of the table, it might be pointed out that physical properties superior to those listed can be secured, in some cases (especially the aluminum alloys) by using, in place of the conventional die-casting machine, one of the type used for making so-called pressure die castings, such as is employed in producing brass and bronze die or "pressure" castings. Data in the table are in most instances, given by the manufacturers of the alloys listed. Compositions given are nominal and in most cases do not include allowable impurities (which in zinc alloys are important) or minor ingredients.

ASTM No. 7 (SAE No. 307) aluminum alloy has good casting qualities and gives the best combination of strength and ductility among the aluminum alloys for die casting. Tensile strength should range from about 32,000 lb. to 35,000 and elongations should be 2% or more. The Charpy impact strength is about 2.5 ft. lb.

Of the aluminum alloys, the high

(Continued on following page)

Table of nominal composition and average physical properties of die-casting alloys

Type of Alloy	ALUMINUM			MAGNESIUM	COPPER (BRASS)			ZINC		
Name or number of alloy ASTM SAE	7 307	5 305	8	B-94-34T	Yellow Brass	Brastil	Doler Brass	21 921	5	23 903
Nominal Composition (percent)	Cu 4.0 Si 5.0 Fe 2.0 (max.) Al balance	Si 12.0 Fe 2.0 (max.) Al balance	Cu 1.5 Si 1.5 Fe 2.25 (max.) Ni 2.0 Al balance	Al 10.0 Mg balance	Cu 58.0 Zn 41.0 Sn 1.0	Cu 80.8 Zn 14.2 Si 4-5	Cu 63-65 Zn 33-34 Si 1.0	Cu 3.0 Al 4.0 Mg 0.02-0.1 High-Purity Zinc balance	Cu 1.0 Al 4.0 Mg 0.02-0.05 High-Purity Zn balance	Cu 0.10 (max.) Al 4.0 Mg 0.03-0.08 High-Purity Zn balance
Tensile Strength (p.s.i.)	28,000-32,000	30,000-34,000	26,000-28,000	28,000-30,000	65,000-75,000	85,000-95,000	70,000-75,000	47,300	41,600	36,100
Yield Point (p.s.i.)	13,000-15,000	13,000-15,000	10,000-12,000	——	35,000-40,000	68,000-70,000	35,000-40,000	——	——	——
Elongation (% in 2")	1.5-2.5	1.5-2.5	3.5-4.5	1-2	15-20	10-15	15-20	8.4	4.2	4.7
Charpy Impact Strength (ft.lb.)	2-3	1.5-2.5	4.0-5.0	1-2	33	36	33	15	17.75	18.25
Shearing Strength (p.s.i.)	22,000	22,000	18,000	——	50,000-55,000	——	——	45,000	38,400	30,000
Brinell Hardness Number	70-75	75-80	60-65	55-60	120-130	160-180	110-130	83	73	62
Specific Gravity	2.78	2.66	2.72	1.81	8.47	8.15	8.50	6.745	6.675	6.644
Weight per cu.in.lb.	0.100	0.095	0.099	0.065	0.035	0.293	0.306	0.243	0.241	0.239
Corrosion Resistance	Fair	Good	——	Low	Good	High	Good	Fair	Fair	Fair
Melting Point (deg. F.)	1145	1060	1195	——	1650	1600	1650	733.6	726.9	727.9

ON THE BOTTOM

● Late in the afternoon, air looks heavy. Sunlight—streaming down through it—looks much the same as sunlight through water. It reminds you again that man is a deep-air animal—that he walks the bottom—and flies only a little above the bottom of the sea of air.

Man and all his engines are high pressure mechanisms—things which could not operate in the ether above our sea of air—which operate less and less efficiently as we move up from our natural habitat on the bottom.

Supercharging compensates somewhat for the lessened pressures of higher altitudes—but not entirely. All aviation engines today are capable of producing more power at sea level than at 10,000 feet. All are capable of producing more power when the barometer is at 31 than when it is at 21.

It is this fact that makes each increment of added power so valuable to aviation—that makes the potential power of high octane fuels vital to the industry today—and tomorrow. Ethyl Gasoline Corporation, Chrysler Building, New York City.

(Continued from preceding page)

(12%) silicon alloy, ASTM No. 5 (SAE No. 305), has the highest tensile strength and the highest corrosion resistance. It is also the lightest alloy and possesses high strength and ductility at elevated temperatures. In addition it is a good casting alloy, having high fluidity and freedom from hot shortness. In consequence, it is excellent for large, thin-walled castings. It affords good resistance to salt-water corrosion and is used for a wide variety of castings, both small and large. Its ratio of yield point to ultimate tensile strength is somewhat lower, however, than for alloys having several per cent of copper. Tensile strength is about 33,000 p.s.i. and Charpy impact 2 ft. lb.

All of the standard aluminum die casting alloys can be anodically coated, but ASTM No. 8 is the best for depth of coating and for resistance to abrasion resulting from the coating.

Magnesium alloys weigh about 60% as much as the aluminum type and when used are employed chiefly for this reason. They machine easily, but are active chemically and corrode in contact with moist air unless protected by a suitable coating. Only one alloy is included in the existing ASTM tentative standard. It has a tensile strength of 28,000 to 30,000 p.s.i. and an elongation of 1 to 2% in 2 in. This alloy contains 10% aluminum and 0.2% manganese, the remainder being magnesium. Its use for die casting has been quite limited to date.

Only two standard zinc-base alloys are recognized by the SAE and the ASTM. Their composition and properties are given in the table, as is that of another approximately intermediate between the two and sometimes designated No. 5. An important consideration with these alloys is that they be made from high-purity (99.99+%) zinc, so that the allowable impurities of cadmium, lead and tin may be kept within the low limits specified, otherwise intergranular corrosion is likely to occur. Although their impact strength is quite high for cast metals, it decreases rapidly below 0° F. and hence these alloys are not recommended where low temperatures are encountered and impact strength at these temperatures is an important consideration. They are widely used in automotive and other applications, however, and rarely fail in service in parts of proper design.

Several of the brass alloys are suitable for die casting, but none are standardized for this class of product, though some standardized for sand casting are suitable for die casting. The alloys listed in the table are perhaps the most widely used in die castings having a copper base, but their aircraft applications are rather limited to date. Their excellent physical properties would seem to justify their wider use, especially in small parts in which the rather high specific gravity of these alloys is not of primary importance. It is significant that tensile strengths as high as 90,000 lb. (which is quite unusual for cast non-ferrous alloys) can be secured. Dies for casting brass alloys do not have the life of those used for alloys of lower melting point, but have ample longevity for the quantity of castings likely to be required in aircraft, as some 50,000 castings can be made in certain of the dies developed for use with the brass alloys listed in the table.

Digest of Technical Articles from Foreign Publications

Spot Welding

Spot Welding in Aeronautical Construction (La Saldatura Elettrica per Punti nelle Costruzioni Aeronautiche, Rivista Sintetica, L'Aerotechnica, Vol. XVI, No. 4, Aprile, 1936)

Opening with a brief account of the oxy-acetylene method of welding, electric arc welding, this summary then deals with spot welding and its characteristics as compared to other available methods. It makes reference to the application of spot welding in the case of carbon, chrome-molybdenum and stainless steels. Next it discusses the type of equipment used and the problem of time and pressure control. At the conclusion, an extensive bibliography on the subject is given from American, English, Italian and French sources.

Design

Notes on an Anti-Traditional Airplane: the Power Glider "S. S. 2" (Note su un Velivolo Anti-Tradizionalista; il Motoveleggiatore "S. S. 2," Capt. G. A. Sergio Stefanutti, Rivista Aeronautica, Anno XII, No. 5, Maggio 1936)

The author describes his Canard SS-2, constructed in the Establishment of Aircraft Constructions, Guidonia. The article opens with the discussion of the reasons which prompted the author to undertake such an unorthodox design, particularly since, although not new, its predecessors (namely that of the German firm Focke-Wulf) were not very successful. Aerodynamic considerations, it appears, were subordinated by the designer to advantages of a purely military nature. Pointing out briefly the visibility limitations of standard designs and stressing the importance of this characteristic in a single seater fighter, the author feels that his selection shows considerable promise in its possible military application.

The article gives a fairly extensive description of the construction and aerodynamic consideration of the design as well as observations and conclusions arrived at from test flights.

Contents of the article include the reasons for design and construction of Canard type airplane; its technical characteristics, take-off, flight and landing; difficulties and defects and their elimination (directional stability, longitudinal stability, aerodynamic efficiency, propulsive efficiency, tail effectiveness, inability of flat-spinning, lifting effect of the fuselage, lack of tail vibrations).

Aerodynamics

Researches on Biplane Cells of Infinite Span (Recherches sur les Cellules Biplanes Rigides d'Envergure Infinite, Miroslav Nénadovitch, Institut Aerotechnique de Saint-Cyr, Publications Scientifiques et Techniques du Ministére de L'Air, No. 86, 1936)

An extensive series of experiments on biplane cell and general review of the wing theory is presented in this paper. The tests described by the author were made in the Aerotechnical Institute of Saint-Cyr under supervision and direction of Albert Toussaint, director of the Institute.

Contents of this work are: monoplane of infinite span; biplane of infinite span; experiments on monoplane of infinite span; experiments on biplane of infinite span; method of calculations of aerodynamic characteristics of a finite span biplane using experimental data on geometrically similar biplane cells of infinite span; wall effect; and experimental polars.

The tests were made using a symmetrical airfoil identical for both wings of the biplane cell, thus reducing the number of possible parameters to two instead of three (thickness and chord without the effect of camber). Experimental cells were varied in gap, stagger and decalage and the range of variations was broad enough to include arrangement, enabling ready interpolation for almost any type of a biplane cell. In addition, the author gives a number of formulae of transformation of immediate practical value. The tests give the characteristics of each wing constituting the cell including moment coefficient.

Aerodynamics in Aviation (L'Aerodinamica in Aviazione, G. A. Crocco, L'Aerotecnica, Volume XVI, No. 4, Aprile, 1936)

The author reviews the fundamental bases of aerodynamics, stressing their importance in practical aviation. The presentation, non-mathematical in style and intended as a general review of the subject, was presented on the occasions of the Conferences of the Circle of Air Forces in Rome and also of the Aerotechnical Association in Milan.

The paper opens with the discussion of the Kutta-Joukowski theorem and the principle of circulation as an explanation of lift of airfoils. Next the inception of circulation is reviewed and connected with it the inception and presence of the initial, trailing and tip vortices. Karman's staggered vortices and resistance of different parts of aircraft are analyzed and the propeller vortex theory is briefly studied.

Taking up the matter of meteorology the author explains the theorem of Bjerkness stressing its importance which in meteorology parallels the importance of Kutta-Joukowski theorem as applied to the theory of flight.

The paper concludes by indicating the importance of experimental research both as a means of verification of the theory and as a means of arriving at qualitative practical data. Despite the

(Continued on following page)

The FORTY FIVE by FAIRCHILD

FOR EXACTING OWNERS

—Who want the finest in Personal Air-Transport . . .

Here, truly, is a new class in airplanes . . . one which combines the design, speed and structural strength of the airliner with the intimacy and handling ease of the privately owned plane. In creating the "45," Fairchild engineers set as their goal a performance found in transport ships. Yet there is no sacrifice of those mobile qualities so typically Fairchild—the ability to take-off and land in a restricted area, steep-angle climb, *instant response to all control*.

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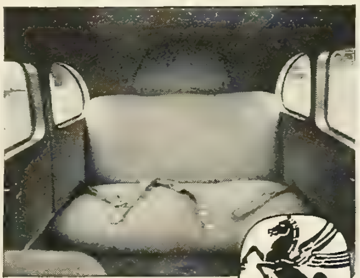


FAIRCHILD

AIRPLANES • CAMERAS • INSTRUMENTS • AERIAL SURVEYS • RANGER ENGINES

(*Continued from preceding page*)

absence of mathematical treatment, this paper is a valuable addition to aerodynamical literature because of its clear interpretation and correlation of physical phenomena and mathematical symbolism.

Simplified Method of Stick Force Calculations. Power Off Condition. (*Méthode Simplifiée pour Calcul des Réactions sur la Manche, R. Pesek, Prague, L'Aérotechnique, No.* 160, *Avril* 1936)

The study is prefaced with the following hypotheses: the constancy of the coefficient of static stability for free-control condition (the method is inapplicable outside of this limitation), the friction in the controls and transmission is negligible, the linkage in all parts of the mechanism remains constant. The study is subdivided into the following steps: the determination of the moment required to bring the airplane into the condition of equilibrium for various angles of attack, elevator setting required to produce a tail moment capable to annul the first moment, elevator hinge moment, the moment due to the pilot's effort.

In addition the paper gives the determination of a number of useful coefficients based on various tests performed in France, Poland and U.R.S.S.

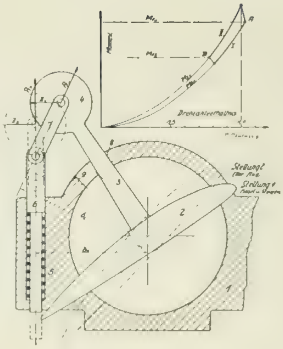
To aid the practical application of the data presented, the author gives a numerical example for a Junkers F.B. airplane.

Instruments

Practical Drift Indicator for Pilots (*Un Derivometro Practico para Pilotos, Joaquin Garcia-Morato, Capitan de Aviacion, Revista de Aeronautica, Num* 49-*Abril* 1936)

Analyzing various types of drift indicators the author points out the difficulties of their use for comparatively inexperienced pilots as well as the mechanical complications involved in their installation. He then describes a simple unit invented and used by him which has considerable practical value as a drift indicator of the inexpensive and simple type. The installation, which may be used successfully on a low wing monoplane or a biplane, consists of a two-foot rod with a bead end detachably attached to the lower wing in a position where it can be readily alined by the pilot with objects on the ground. A set of radial lines are drawn on the leading edge of the wing with the bead as a center, these lines representing 5° of drift, the zero drift line being parallel to the center line of the airplane.

The article explains the almost obvious use of this device and gives practical suggestions of the installation and marking.



Propellers

Schwarz Automatic Variable Pitch Propeller (*Schwarz-Propellerwerk, Flugsport, XXVIII, Jahrgang No.* 10, *Mai* 1936)

The article gives a description of the new Schwarz propeller hub, which enables automatic variation of propeller blade setting in flight. The mechanism permits the blades to automatically assume one of two possible pitch settings, one for take-off and climb and another one for level flight. The principle used consists of utilizing centrifugal force of special weights rigidly attached to the blades and connected in turn by a link to a spring-controlled plunger. The relative change in centrifugal moment, linkage and spring compression enables the achievement of the desired variation while special stops limit the angular position of the blades. Operation is positive in action and once in high pitch attitude, the engine may be throttled down considerably before the change to low pitch position takes place. The article makes reference to flight tests made with the Schwarz propeller and illustrates also a three-bladed propeller with the Schwarz automatic hub.

Structures

I—Calculation of Columns Elastically Restrained at the Ends. II—Bending of Truss Members with Rigid Joints. (*I—Calcul des Poutres Comprimées Encastrées Elastiquement á leurs Extremités. II—Flambage de Barres de Treillis Assemblées Rigidement, Henri Rivière, L'Aeronautique, No. 200, Janview 1936*).

The author approaches the solution of both cases by determining the length between the points of inflection for a given condition at the ends of a member. Once this length is calculated the strength of the member is defined by the condition given by Euler's equation for pin ended columns. The article gives two tables and two diagrams to facilitate the practical application of the proposed method. A step by step process of calculation is also given.

Stress Analysis

Shear Stresses in Hollow Sections. An account of the Theory of Stresses in Bending and Torsion for Designers of Stressed-Skin Structures. By W. J. Goodey, M. A., Aircraft Engineering, No. 86, *April*, 1936.

The following summary is extracted from the article.

"The shear stress distribution in hollow sections subjected to bending and torsion is a subject about which there does not appear to be much information in standard textbooks. The first part of this article deals with the shear stress distribution in a beam of hollow section with internal partitions, when subjected to bending. Particular importance is attached to the numerical examples which follow, for although the underlying theory is simple the numerical work is apt to be very involved.

The shear stress distribution due to torque forms the subject of the second section of the article.

Ice Formation

Flying Through Clouds. The Formation of Ice. (*La Navigazione Aerea Attraverso le Nubi; Le Formazioni di Ghiaccio. Comandante Valentino Pivetti, Rivista Aeronautica N.2, Febbraio, 1936*).

The author presents in this article his observations on formation of ice made in the course of his regular work as a pilot with the civil air transportation company "Ala Littoria." He points out that any individual set of notes is necessarily limited in scope because of technical limitations of the observer, his flight experience and individual ability. The article points out that in the case of clouds encountered with the condition of small humidity no ice formation has been observed. These clouds are cirri cumuli, alto cumuli, strato cumuli, cumuli and also alto strati. The formation of ice has been always observed in the presence of strati, cumuli nembi and nembi. The article treats at length the formation of ice under different conditions and gives an extensive discussion of navigation problems in their relation to meteorology.

Engines

Fuel Consumption and Heat Losses in Aircraft Explosion Engines (*Kraftstoffverbranch und Wärmebelastung des Zündezflugmotors, K. Löhner und Th. Helmbold, Luftfahrt-Forschung, Band 13, 20 Januar 1936 N21*).

Stressing the importance of specific fuel consumption on long range possibilities of the aircraft the authors compare the methods being resorted to abroad and in Germany. The automatic mixture control permitting the use of leaner mixtures and employed in Great Britain is in their opinion only a partial solution of the problem. They feel that Hobson Regulator does not exploit all the possibilities and the purpose of the article is to outline certain finding of research undertaken by the authors some time back. They feel that for better understanding of the problem, the theory of combustion requires a new approach.

To explain the theoretical justification of the proposed improvements in fuel consumption a condensed review of the basic principles is given in the article as well as the experimental data in connection with laboratory research which paralleled the study.

Elasticity

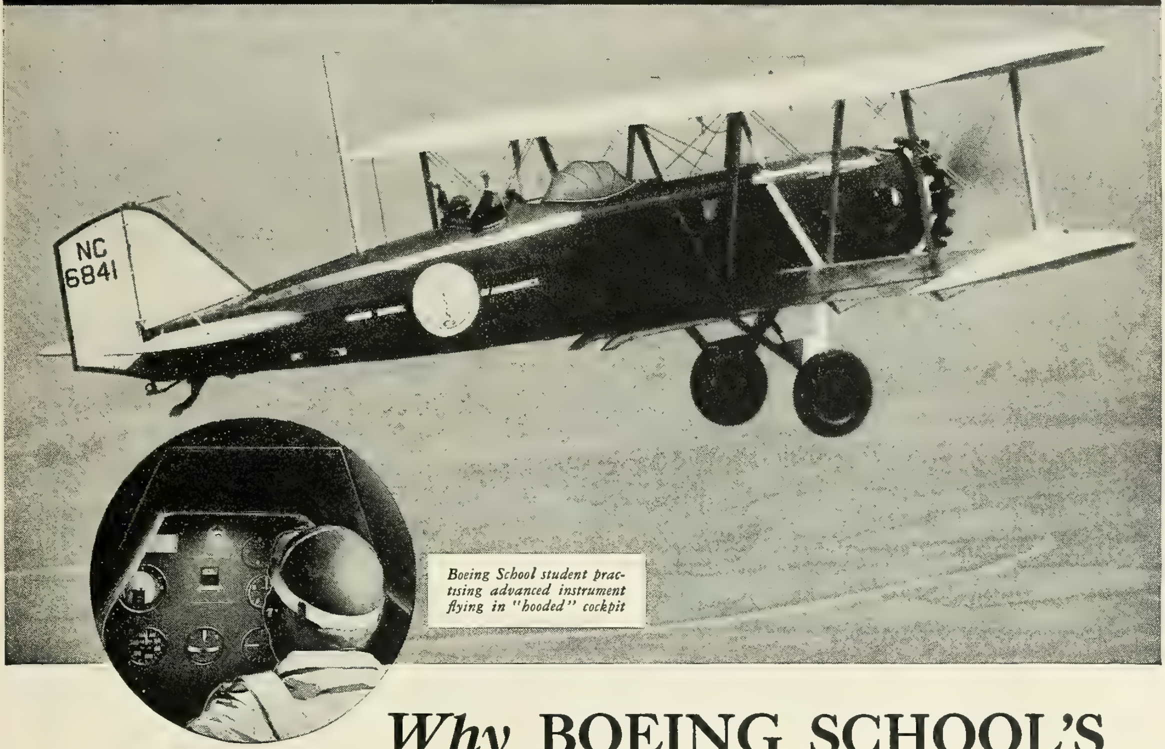
Research of Resistance of Variable Height Beams (*Recherche des Contraintes dans les Poutres de Hauteur Variable, V. A. Nicolsky, Ingénieure-Docteur, Publications Scientifiques et Techniques du Ministére de L'Air, No.* 84, 1936)

The French term *contrainte* is defined as a vector expressing the elastic state of material, whose dimension is that of a force divided by area. The normal component of this vector is called the tension while the tangential one is the shear. The paper treats the determination of these stresses for the case of a variable height beam. The usual solutions by ordinary approach of the strength of materials cannot be applied in many instances and use is made of the theory of elasticity to arrive at fundamental formulae of empirico-theoretical nature. The author first presents the graphical solution of web type beams by the Résal method showing how external shear may be increased or decreased in the web assuming that the web takes only the shear loads while the flanges are subjected only to the loads tangential to the beam's contour. To distinguish the shear in the web from the shearing load the author renames the former "sliding effort".

He indicates that the former method leaves a possibility of an error in the sign of this stress and the paper presents an algebraic expression which is in accord with the results obtained graphically. Another difficulty encountered normally is the choice of principal planes and the paper offers a solution in this respect as well.

In order to retain simplicity of solutions the paper makes a common assumption used in the solution of prismatic beams namely, the linear distribution of stresses normal to the principal sections.

40 HOURS "under the hood"



Boeing School student practising advanced instrument flying in "hooded" cockpit

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FIRST OF ALL, a word of advice: Take plenty of time in selecting your air school. *Itemize exactly what you get for each hour and each dollar you put in.*

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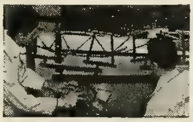
You study 48 subjects in the fields of Design, Metallurgy, Fabrications, Power Plants, Air Law and Regulations, Meteorography, Avigation, Communications, Airline Operations, and Sales. And you get *250 hours* of dual and solo instrument and beam flying in 10 different planes. You fly 8 distinct types—from modern 165 h. p. trainers to 1350 h. p. transport, the largest in any school in the United States.

Chief Pilots Addems, Williams, Lewis

Three of the United officials who help plan Boeing School courses

Static wing-rib test

School's 11 shops and laboratories contain equipment of a type ordinarily found only in airplane factories



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EQUIPMENT and METHODS

Gasket Compound

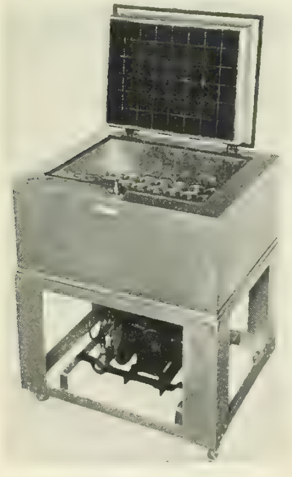
A new gasket compound called *Seal-Aide* was developed by Victor Mfg. & Gasket Co. While particularly adapted to steel-faced, all-metal and heavily reinforced cylinder heat gaskets, this compound will hold treated paper or cork gaskets in place during assembly. Application is by brush which allows a thin even film.

Features are: no loss to sealing qualities under engine heat; no tendency to cause gaskets to stick to joint faces; and a non-mixing agent with water, oil or gasoline.

Dural Rivet Refrigerator

Antiquating the dry ice box, a portable electric refrigerator for aircraft manufacturing use is being marketed by Jewett Refrigerator Co., Inc.

Designed especially for the treatment of aluminum alloy rivets, this unit is equipped with 48 individual containers, each having about 19 cu. in. capacity. These containers are partially submerged in a bath of non-freezing solution and held at constant predetermined temperatures usually 0° F., although some manufacturers maintain and keep a constant temperature despite frequent openings of the box, of —6° to —10° F. The non-freezing solution used practically eliminates frosting and causes no harmful effects to the rivets even after they have been immersed for as long as two months.


Jewett refrigerator for rivets

The unit measures 36″ high and occupies a floor space 31.5″ × 26.5″. It is equipped with roller casters and has heavy corkboard-insulated walls. Metal seams are sealed against air leakage into the insulation.

Power for the compressor is supplied by a ⅛ hp engine of either 25 or 60 cycles, 110 to 220 volts, and the unit can be operated on approximately 5 kwh in 24 hours.

Jewett also produces a low temperature unit for aluminum alloy stampings. This refrigerator measures 24″ × 30″ and stands 36″ in height.

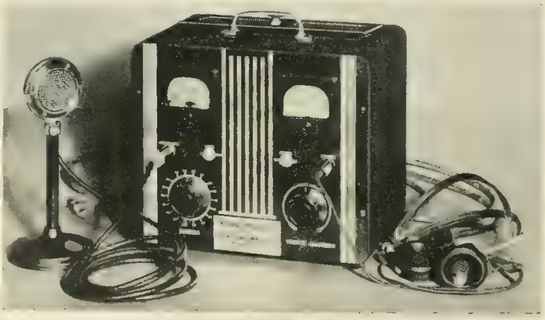
Sound Level Indicator

A new sound level indicator, product of the Industrial Apparatus Co., Chicago, Ill., is designed to measure sound levels as heard by the human ear. The unit should prove valuable to the design engineer in noise level reduction work.

The user can secure accurate data on sound and noise levels, thereby reducing testing and manufacturing costs. Since accurate readings can be quickly secured, manufacturers can test their production for uniform noise levels.

The sound level indicator consists of a calibrated crystal type microphone, an audio frequency amplifier (with all-metal tubes), a calibrated attenuator, an ear weighing network, a decibel meter and a crystal type headset. The range is from 30 to 90 db. A.S.A. standard. Although designed for ac. operation, batteries may be used.

Industrial apparatus sound level indicator for measuring sound



Hypressure Jenny

Homestead Valve Manufacturing Co., who for several years has been manufacturing high pressure vapor spray cleaning equipment under the trade name of *Hypressure Jenny,* announces a low-priced cleaning stationary or portable unit known as Model G. Operation is on the same principle as previous models, the cleaning being accomplished by applying through a nozzle to the surfaces to be cleaned, a combination of water vapor, hot water and cleaning chemicals, over a pressure range from 50-150 lbs./in.^{2}.

Vapor pressure is developed by a vertical-spiral-parallel-coil type vapor generator, and is controlled by an automatic pressure control switch. The vaporizing oil burning system utilizes kerosene or light furnace oil. Pilot flame is obtained by manual ignition, but is retained automatically after starting.

A saturation selector enables the operator to change the spray and have a wetter or dryer vapor as needed to obtain the proper operating effect. Paint thus may be stripped by using hot water containing a strong alkali; or by adjusting the spray and pressure, tar or heavy grease may be blasted off.

Efficiency has been increased by the development and use of a single triplex plunger pump equipped with mechanically operated inlet check valves.

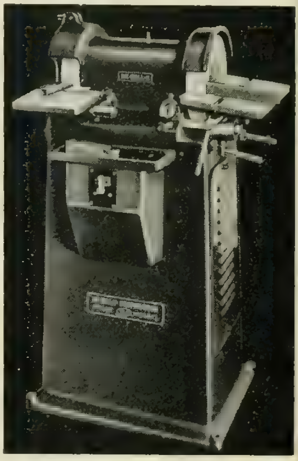
Carbide Tool Grinders

The Ex-Cell-O Style No. 46 carbide tool grinder is designed for rapid, economical grinding and lapping of single point cemented carbide tipped turning, facing and boring tools. Diamond wheels, silicon carbide vitrified cup wheels or diamond lapping discs can be used on this machine. There are three different methods of grinding: a roughing and finishing cut can be taken with two silicon carbide cup wheels; roughing with silicon carbide cup wheel and finishing with diamond wheel; or roughing with silicon carbide vitrified cup wheel and lapping with a diamond lapping disc.

Tools up to ⅝″ square shank are rough and finish ground with silicon carbide vitrified wheels.

The Ex-Cello-O Style No. 48 carbide tool grinder is designed for dry grinding all sizes of single point turning, facing and boring tools (right or left hand), high speed steel and cemented carbide tools of the larger size range. Both peripheral grinding on straight type vitrified wheels and face grinding on cup type vitrified wheels can be done.

Both grinders are of the double-end type driven by a double Vee belt from an electric motor located in the base.

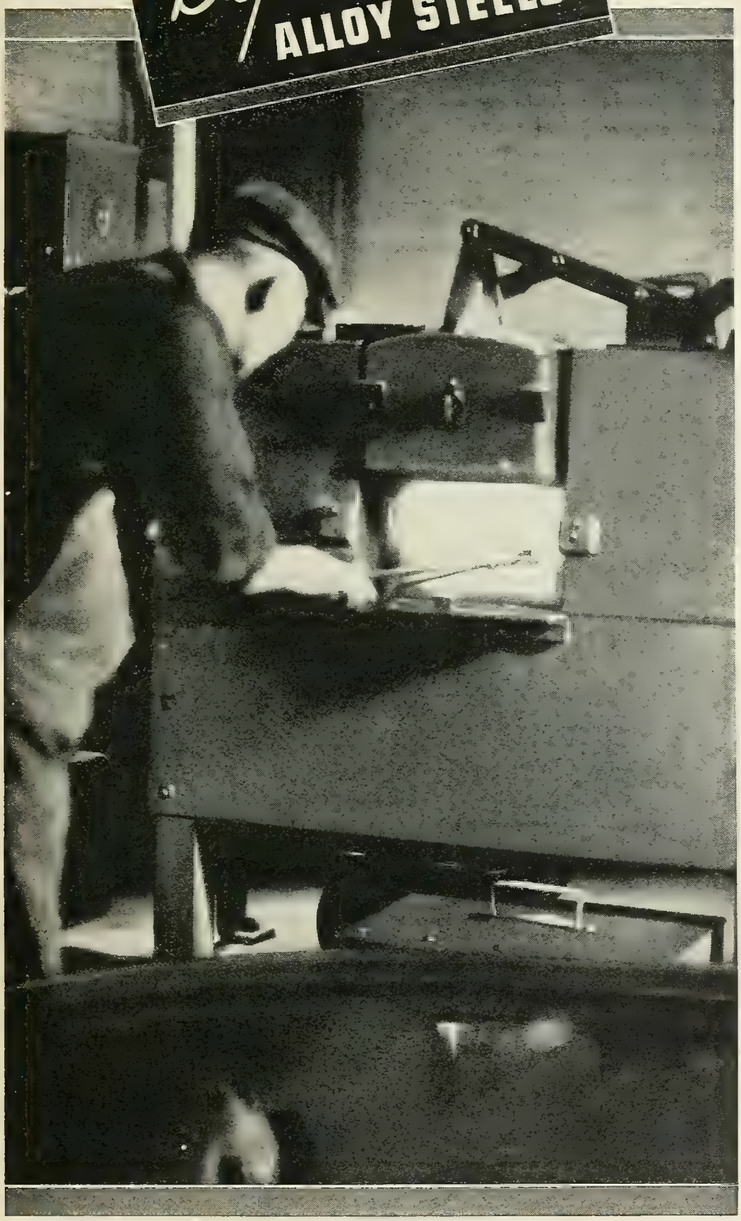

Ex-Cell-O carbide tool grinder

Reference Charts for Nickel Steel

International Nickel Co., Inc., has developed two circular revolving charts for quick and easy reference. One, for wrought nickel alloy steels, is a general guide and refers only to simple shapes from 1″ to 12″ in diam-

(*Continued on following page*)

Dependable ALLOY STEELS . . . THEIR QUALITY SHOWS UP IN SERVICE



GETTING READY FOR THE PHYSICALS. *After the chemistry of a heat of Carnegie-Illinois Alloy Steel has been checked, samples cut from billets are taken for analysis in the physical laboratories. But first they are subjected to heat treating under carefully controlled pyrometric conditions. In these heat treating laboratories the steel is checked for structure, physical properties and performance under working conditions imposed by the customer.*

IN an alloy steel, quality is but another term for utility. For by quality we mean not only that the steel must measure up to specific and predetermined requirements—must have definite physical, metallurgical and chemical properties—but that it must be *consistently uniform* in those properties from bar to bar, from heat to heat, from shipment to shipment.

This uniformity, this unvarying dependability which distinguishes Carnegie-Illinois Alloy Steels, we obtain through scientific control of every step in manufacture. For Carnegie-Illinois alloy mills are operated on the principle that quality in alloy steels demands the most exacting control of the mechanics of rolling, as well as the metallurgy of the steel itself.

From billet to shipping floor every step is subjected to rigid control and to relentless inspection. The result is an alloy bar free of physical defects or blemishes, straight as a die, finished to save costly operations in your own plant. We know of no mill practice more exacting or carrying greater assurance of quality steel.

• • •

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
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San Francisco
Export Distributors: United States Steel Products
Company, New York

US STEEL

UNITED STATES STEEL

(Continued from preceding page)

eter. It indicates compositions recommended to obtain yield points of from 55,000 to 175,000 lbs./in.^{2} in uniform sections, together with suitable heat treatments, and typical properties developed.

The nickel cast iron chart is designed for engineers and foundrymen. It automatically furnishes the composition and properties of alloy irons recommended for 49 applications including a special section on aircraft engine cylinders.

Degreasing Fluid

Research in colloidal chemistry has resulted in the development of a hydro-degreasing fluid called *Gunk*, manufactured by the Curran Corp.

Its use being applicable to grease-cleaning and removal, in aviation it can be utilized for eliminating grimy accretions of oil and grease on fabric- and metal-covered surfaces, for washing and cleaning engines and engine parts, and for degreasing hangar and shop floors.

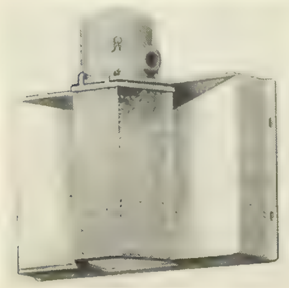
A mixture of *Gunk* and kerosene or fuel oil will make mineral oils and greases into a water soluble state by changing their nature. They are then washed or rinsed away, leaving a clean surface.

Parts are degreased by immersion in a *Gunk*-kerosene solution. After soaking, they are hosed off with cold or hot water. In the latter case they are dried by the hot water rinse, and are brightened without loss of weight, etching or staining.

The solution is harmless to doped or lacquered finishes, has no action on aluminum, and is not a fire hazard. Nicholas Beazley handles the sale of this solvent at its bases in Marshall, Mo.; Glendale, Calif.; Dallas, Tex., and Brooklyn, N. Y.

Utility Floodlights

Better lighting for hangar interiors is possible with the new Utility Floodlights manufactured by the Pyle-National Co. These lights, which can replace the overhead type which is objectionable because of wing surface interference, are mounted to any convenient post or wall.



For hangar installations, they are placed in staggered positions about 20 ft. apart, with every other one occupying a position about 14 ft. high for general illumination. Those in between are set 6 ft. high to give proper underwing illumination.

Ornamental as well as practical, these lights have a cast iron housing with an acid-resisting porcelain enamel coating. The glass frame is also cast aluminum while the door glass is of the translucent rippled type. Two units are available—a small size for 150- or 200-watt lamps, and a larger size for 300- or 500-watt lamps. Both have a special reflector curve that projects a 170° horizontal and a 135° vertical beam of uniform and well-diffused character. The area directly down is illuminated by direct light from the bottom of the lamp. Cleaning and relamping is simplified by an upward swinging hinged front.

Portable hangar for storing small aircraft

Portable Hangar

An individual hangar that can be set up or knocked down within a few hours is being sold by Bennett Air Service.

Having a frame of wood and steel, and galvanized iron doors, sides and roof covering, the hangar will accommodate most types of private airplanes in its space of 40 × 26 ft., and a door clearance of 9 ft. Parts that can be shipped as units are built at the factory; each is marked and labeled and the complete unit can be easily assembled by bolting.

Doors are of a combination folding and track and roller type, built completely at the factory.

Multiple Circuit Electric Connectors

Breeze multiple circuit electric connectors were built to Army Air Corps specifications and designed for aircraft and aircraft-instrument installations, to provide a quick and positive method to connect or break simultaneously a multiplicity of electric circuits.

These connectors are for applications where weight and space are factors. They are available in sizes taking two 200 amp. and one 25 amp. wires; for two 25 amp. and twelve 10 amp. wires, and for four 10 amp. wires.

High Octane Blending Agent

Petroleum chemists have been seeking new materials suitable as high anti-knock fuels by themselves or as blending agents in the preparation of base stocks to which some anti-knock compound such as tetraethyl lead could be added in small quantities to give the desired high anti-knock value. Technical iso-octane is one such material commercially available, but the petroleum industry has succeeded in providing a new material to supplement it. This material is isopropyl ether. Contrary to the behavior of ethyl ether (which is a violent knock inducer) isopropyl ether along with some other ethers has been found to be a good anti-knock fuel. During the past eight years experimentation has progressed on this material and methods of manufacture studied until at this time it appears to be an important factor in the solution of the high anti-knock fuel problem. Full scale multi-cylinder engine tests have demonstrated its anti-knock qualities and in physical characteristics it apparently meets the requirements of present-day military and commercial aviation fuel specifications when blended with aviation gasoline in proportions to give 100 octane with 3 cc. of lead tetraethyl.

Although a low boiling material, isopropyl ether's vapor pressure is below the maximum allowed for aviation gasolines and when blended therewith, vapor pressures are entirely suitable. Freezing point is low and thus it does not have this disadvantage of the benzene or benzol-blend fuels. Latent heat of vaporization (while lower than for benzene) is comparable with that for iso-octane and consequently the same maximum engine horsepower would be anticipated from considerations of mixture cooling effect, and no increase in tendency to cause carburetor icing due to excess refrigerating effect would be anticipated. Heating value on both a weight and volume basis is lower than for either iso-octane or benzene and this normally would be expected to give a reduction in miles per gallon or conversely would require greater tank capacity for a given cruising radius. The magnitude of this disadvantage is in proportion to the quantity of isopropyl ether used in the final blend and may be wiped out in practical blends by permitting leaner air-fuel ratios without excessive heat temperatures.

In considering the physical characteristics of aviation gasolines, the subject of water tolerance is important. Existing specifications for water tolerance of aviation fuels require only that, when 80 ml. of the fuel are shaken with 20 ml. of water at room temperature, the increase in volume of the water layer shall not exceed 2 ml. This requirement is directed against the use of alcohol blends from which the alcohol is usually easily separated by the addition of water. Isopropyl ether has only slight solubility in water and the above water tolerance test usually shows no measurable increase in the water layer, even when concentrations of 40% are used in blends with aviation gasoline.

Data are available in regard to the octane number and lead susceptibility of blends of isopropyl ether by various methods. A study of these shows the following conclusions in regard to performance on single cylinder test engines:

Blended in commercial aviation gasolines, a fuel of 100 Army octane is possible with 40% of isopropyl ether without exceeding 3 cc. of lead tetraethyl; the blending value of isopropyl ether is slightly superior to the blending value of technical iso-octane in unleaded blends and also superior for any fixed amount of lead tetraethyl in the corresponding blends; when blended with 74-75 octane gasoline, and without exceeding 3 cc. of lead per gallon, an octane number of approximately 101-102 is the maximum possible when using technical iso-octane as a blending agent, whereas isopropyl ether will give at least 105 in concentrations of about 65% or more; the amount of lead tetraethyl necessary to meet a given octane number is less for isopropyl ether than for technical iso-octane in blends containing the same percentage concentrations.

The new compound, tentatively called EL-435, was discovered by H. E. Buc, research chemist in the Esso laboratories.

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SHELBY Seamless Aircraft Tubing, made by America's largest and most experienced manufacturer of mechanical tubing, conforms to the highest standards set by the United States Army and Navy specifications. Available in chrome-molybdenum, mild carbon and stainless steels, both round* and streamline sections. Quick delivery from stock assured by distributors located conveniently at hand. These stocks are carried in specific lots, so that actual test reports which accompany shipments can be furnished for each lot at time of delivery.

*Round Tubing is also available in SHELBY "BF" Aircraft Tubing, which has an improved bright outside finish.

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UNITED STATES STEEL

INDEX TO THE MANUFACTURERS OF FABRICATED PARTS AND AIRCRAFT MATERIALS

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(Raw Materials)
(Also see Castings and Forgings; Miscellaneous Hardware)

Bar Stock
Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Aluminum Co. of America
Steel Sales Corporation

Cable
Aircraft Steel & Supply Co.
Aluminum Co. of America

Extruded Shapes
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American Magnesium Corp.
Bohn Aluminum & Bronze Corp.
Dow Chemical Co.
Mueller Brass Co.

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American Tube Bending Co.
Metal Goods Corporation

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Aero Supply Mfg. Corp.
Aluminum Co. of America

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Aluminum Co. of America
American Forge Co.
American Forge Works
American Magnesium Corp.
Atlas Drop Forge Company
Atlas Steel Casting Co.
Bausch Machine & Tool Co.
Bearium Metals Corporation
Bethlehem Steel Co., Inc.
Billings & Spencer
Bohn Aluminum & Brass Corp.
Bonney Forge & Tool Works
Bunting Brass & Bronze Co.
Camden Forging Company
Canton Drop Forging & Mfg. Co.
Champion Machine & Forge Co.
Davenport Drop Forge Co.
Dayton-Rogers Mfg. Co.
Detroit Steel Casting Co.
Doehler Die Casting Co.
Dow Chemical Company
Eastern Malleable Iron Co., Inc.
Eclipse Aviation Corp.
Endicott Forging & Mfg. Co.
Farrell-Birmingham Co.
Farrell-Cheek Steel Foundry
Federal Mogul Corp.
General Drop Forge Co., Inc.
General Metals Company
Gibson & Clark
A. P. Grimm Foundry
Hamilton Foundry & Machine Co.
Industrial Steel Casting Co.
Krodel Foundry
Ladish Drop Forge Co.
Lebanon Steel Foundry
Lumen Bearing Company
McPherson Foundry Co.
Metal & Alloy Specialty Co.
Motor Casting Company
Oklahoma Steel Casting Co.
Park Drop Forge Co.
Phillips Bronze Bushing Works
Progressive Brass Co.
Horace T. Potts
Reliable Pattern Co.
D. J. Ryan Foundry
Standard Brass Mfg. Co.
Steel Improvement & Forge
Superior Foundry Co.
U. S. Foundries, Inc.
Warman Steel Casting Co.
J. H. Williams & Co.
Wyman-Gordon Company

COWLINGS, MANIFOLDS, COLLECTOR RINGS
American Tube Bending Co.
Brewster Aeronautical Corp.
Buhl Stamping Company
Engle Aircraft Specialties
National Tube Company
Pollak Mfg. Co.
Solar Aircraft Co., Ltd.
Stearman Aircraft Corp.
Superior Metal Sp'n'g & Mfg. Co.

CONNECTING RODS
Canton Drop Forging & Mfg. Co
Champion Machine & Forging Co.
Govro-Nelson Company
Lincoln Machine & Tool Co.

COPPER AND ITS ALLOYS
(Raw Materials)
(Also see Castings and Forgings; Miscellaneous Hardware)
Ajax Metal Company
Alloys & Products, Inc.
T. E. Conklin Brass & Copper Co.
Michigan Smelting & Refining Co.

Bar
Bernitz Mfg. Company
Chase Brass & Copper Co.
Federal-Mogul Corporation
Mueller Brass Company
Seaboard Brass & Copper Co

Tubing
American Brass Co.
American Tube Bending Co.
Brass & Copper Sales Co.
Chase Brass & Copper Co.
Ducommon Corporation
National Copper & Smelting Co.
C. A. Roberts Company
Seaboard Brass & Copper Co.
Steel Sales Corporation
Wolverine Tube Company

Sheet
Chase Brass & Copper Co.
Phosphor Bronze Smelting Co.
Titan Metal Mfg. Co.
Wheeling Corrugating Co.
Whitehead Metal Products

Wire
Chase Brass & Copper Co.
John A. Roebling's Sons Co.
Seaboard Brass & Copper Co.
Steel Sales Corporation
Wheeling Corrugating Co.

(Fabricated Parts)
Chase Brass & Copper Co.
Revere Copper & Brass, Inc.

Bearings
Bunting Brass & Bronze Co.
Cleveland Graphite Bronze Co.
Federal Mogul Corp.
McGill Mfg. Company
Premier Bronze Corp.

Bushings
Federal Mogul Corp.
Johnson Bronze Co.
Progressive Brass Co.

CORK
Armstrong Cork Company
Atlantic-Pacific Mfg. Co.
The Crown Cork & Seal Co.
Dodge Cork Co., Inc.
L. Mundet & Sons

CRANKCASES
Bohn Aluminum & Brass Corp.
Govro-Nelson Company

CRANKSHAFTS
Canton Drop Forging & Mfg. Co.
Champion Machine & Forging Co.
Govro-Nelson Company
Leland Gifford Co.
Muskegon Specialties Co.
J. W. Nelson Company
Ohio Crankshaft Company
Park Drop Forge Company
Union Drawn Steel Co.
Wyman-Gordon Co.

CYLINDER BARRELS
Brown & Sharpe Mfg. Co.
Canton Drop Forging & Mfg. Co.
Cheney & Sons
General Metals Company
Govro-Nelson Company
Taylor Wharton Iron Steel Co.

CYLINDER HEADS
Bohn Aluminum & Brass Corp.
Govro-Nelson Company

FABRICS, ETC.

Carpeting
Sidney Blumenthal & Co.
Geo. A. Carpenter
L. C. Chase & Company
Hirst-Rogers Company
Laidlaw Company, Inc.
Mohawk Carpet Mills
Sanford Mills
F. Schumacher & Company
J. H. Thorp & Company
Wm. Wiese & Co., Inc.

Covering
Aircraft Steel & Supply Co.
Suncook Mills
Thurston Cutting Corp.
Wm. Whitman Company
Wellington Sears Co., Inc.

Drapery
Sidney Blumenthal & Co.
Laidlaw Co., Inc.
F. Schumacher & Company
Wm. Wiese & Co., Inc.

Leather, etc.
American Oak Leather Co.
Anderson Flax Fibre Co., Inc.
Blanchard & Lane
Chicago Rawhide Mfg. Co.
Conneaut Leather Co.
Eagle Ottawa Leather Co.
Graton & Knight
E. F. Houghton & Co.
Pantosote Co., Inc.
Radel Leather Co.
A. G. Seaver
H. D. Taylor
U. S. Rubber Products, Inc.

Tapes
Arbeka Webbing Co.
Suncook Mills
Thurston Cutting Corp.
Wellington Sears Co., Inc.

Upholstery
L. C. Chase & Co.
Cleveland Tanning Co.
L. F. Fechtmans & Co.
G. W. Gillette & Co.
Laidlaw Company, Inc.
Porter Top Co.
A. G. Seaver
F. Schumacher & Company
Don Tallmadge Company
Wm. Wiese & Co., Inc.

Webbing
Hope Webbing Co.
C. W. House & Sons

FELT
American Felt Company
American Hair & Felt Co.
Booth Felt Co., Inc.
Coffeys Felt Company
The Felters Co., Inc.
C. W. House & Sons
Western Felt Works

FIBRE
Continental Diamond Fibre Co.
Ellfeldt Hardware Company
Formica Insulation Company
National Vulcanized Fibre Co.
Spaulding Fibre Company
White Supply Company
Wilmington Fibre Specialty Co.

FITTINGS
Breeze Corporations, Inc.
Commonwealth Brass Co.
Dole Valve Company
Engel Aircraft Specialties
Husband Aircraft Specialtie
Lunkenheimer Co.
Stewart-Warner-Alemite Corp.
Nicholas-Beazley Airplane Co.

FLEXIBLE TUBING
Breeze Corporations, Inc.
Chicago Tubing & Braiding Co
Eclipse Aviation Corporation
Parker Appliance Company
Roberts Tube Works
Seamlex Corporation
Service Steel Company
Titeflex Metal Hose Co.
U. S. Flexible Tubing Co.
United Metal Hose Co.
United Wire & Supply Corp.

GASKETS
Detroit Gasket Company
Fitzgerald Mfg. Company
Garlock Packing Co.
Goetz Gasket & Packing Co.
McCord Radiator & Mfg. Co.
Raybestos-Manhattan, Inc.
Thiokol Corporation
Vellumoid Company
Victor Mfg. & Gasket Co.
Western Gasket & Packing Co.

(Continued on following page)

"Fastest-Shortest-Coast to Coast"

Powered Exclusively by

WRIGHT CYCLONES

Wright Cyclones power all of the de luxe Douglas Skyliners operated by Transcontinental & Western Air—the shortest, fastest route from New York to California.

The famous TWA "Sky Chief" leaves New York at 5 P.M. and arrives in Los Angeles at 8 A.M. the next morning. This flight is one of six fast transcontinental schedules operated daily out of New York by "The Lindbergh Line."

TWA has long operated a non-stop service, in both directions, between New York and Chicago. Morning, noon, afternoon and night TWA offers convenient schedules between America's largest cities. On June 13th, 1936, the "Sky Chief" made the New York-Chicago run, with a capacity load, in the record-breaking time of 3 hours and 48 minutes—57 minutes ahead of schedule!

The Chicago-New York commercial transport record, also established by a TWA Cyclone-powered Douglas Skyliner, was made last winter in 2 hours and 54 minutes—at an average speed of 252 miles per hour.

The Wright Cyclone is the most powerful single-row, radial, air-cooled engine in service operation. Cyclones are used exclusively on TWA and other leading airlines of the United States—and they power the fastest transports on leading airlines throughout the world. "Powered By Wright" is your assurance of swift, dependable "Travel By Air."

New TWA Schedules!
Non-Stop Flights
New York to Chicago
Overnight
New York to California

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

The following directory of manufacturers of fabricated parts and raw materials is an up-to-date revision of the data which appeared last year. The accompanying index indicates the manufacturers listed. Complete data relating to the companies is given in the directory section (pages 70 to 90) where manufacturers are listed alphabetically. Companies marked * are also listed in the April "Digest of Aircraft and Aircraft Engines"; those marked † are listed in the October "Digest of Airport Equipment."

(Cont. from preceding page)

GEARS, SPROCKETS
Bilgrim Gear & Machine Works
Billings & Spencer Co.
Boston Gear Works
Brown & Sharpe Mfg. Co.
Canton Drop Forging & Mfg. Co.
Champion Machine & Forge Co.
Diamond Chain & Mfg. Co.
Endicott Forging & Mfg. Co.
Indiana Gear Works
Lumen Bearing Company
Miesel Press Mfg. Co.

GLUE, CEMENT, WAX
Adex Mfg. Company
Casein Mfg. Co. of Amer., Inc.
Dolphin Paint & Varnish Co.
L. W. Ferdinand & Co.
S. C. Johnson, Inc.
Westinghouse Elec. & Mfg. Co.

HARDENED AND GROUND PARTS
Abegg & Reinhold Co.
Coast Centerless Grinding Co.
Cook Heat Treating Co.
Govro-Nelson Company

HOSE CLAMPS
Ideal Clamp Mfg. Co., Inc.
Screw Machine Products Co.
Wittek Mfg. Company

INSULATED WIRE, CABLE
Aerial Machine & Tool Corp.
American Enameled Magnet Wire
American Steel & Wire Co.
Belden Mfg. Co.
Boston Insulated Wire & Cable Co.
General Cable Corp.
Mica Insulator Company
Packard Electric Corp.
John A. Roebling's Sons Co.
Runzel Cord & Wire Co.
U. S. Rubber Products, Inc.

INSULATING, SOUNDPROOFING
American Hair & Felt Co.
Anderson Flax Fibre Co., Inc.
Booth Felt Co., Inc.
Chicago Curled Hair Co.
Dry-Zero Corp.
Formica Insulation Co.
Johns-Manville, Inc.
Rubatex Products, Inc.
Saftee Glass Company
Saylor Elec. & Mfg. Co.
Seaman Paper Company
Spaulding Fibre Company
Wilmington Fibre Spec. Co.
Wood Conversion Company

LINK PINS
Burgess Norton Mfg. Company
Greist Manufacturing Co.
Marquette Metal Products Co.
Wichita Wire Products Co.

MISCELLANEOUS HARDWARE
Aerial Machine & Tool Corp.
Aero Supply Mfg. Corp.
Air Associates, Inc.
Aluminum Co. of America
Aluminum Industries, Inc.
American Screw Co.
Apex Machine & Tool Co.
Atlas Tack Corporation
Buffalo Machine Key Co.
Chicago Screw Company
C. R. Daniels, Inc.
Dardelet Threadlock Corp.
Detroit Screw Co.
Detroit Stamping Co.
Diamond Chain & Mfg. Co.
Dzus Fastener Co.
Elastic Stop Nut Corp.
Elco Tool & Screw Corp.
Emsco Asbestos Company
Ex-Cell-O Aircraft & Tool Corp.
Hartford Machine Screw Co.
Industrial Eng. & Mfg. Co.
Kellogg Switchboard & Supply Co.
Lamson & Sessions Co.
Marquette Metal Products Co.
Milford Rivet & Machine Co.
National Lockwasher Co.
Nicholas-Beazley Airplane Co.
Palnut Company
Parker-Kalon Corporation
Penn Rivet Company
Positive Lockwasher Co.
Quadriga Mfg. Company
Republic Steel Corp.
Rhode Island Tool Co.
John A. Roebling's Sons Co.
Joseph T. Ryerson & Son, Inc.
Shakeproof Lock Washer Co.
Standard Screw Company
Standard Steel Specialty Co.
Steel Products Eng. Co.
Stewart-Warner-Alemite Corp.
E. B. Stimpson Company
United Carr Fastener Corp.
Waterbury Button Company
Worcester Taper Pin Co.

MOLYBDENUM
Climax Molybdenum Corp.
Universal Steel Co.

PAINT, DOPE, VARNISH, LACQUER, ENAMEL
(Initials in brackets indicate products)

Acme White Lead & Color Wks. (E)
American Chemical Paint Co.
Berry Bros (D-P-E-L-V)
Brooklyn Varnish Mfg. Co. (P)
Camel Lead Color & Chemical Products Mfg. Co.
Cook Paint & Varnish Co. (P-D)
Dearborn Chemical Co.
Dibble Color Company
E. I. duPont de Nemours & Co., Inc. (P-V-L-D)
Egyptian Lacquer Co. (P-E)
Frey-Yenkin Paint Co.
W. P. Fuller & Co. (D-E-L)
Glidden Co. (P-D-V-L-E)
Hilo Varnish Corp. (P-V-L-E)
Jones-Dabney Co., Inc. (D-V-L-E)
Kay & Ess Co. (D-L-E)
Lowe Bros. Co. (P-V-E)
Merrimac Chemical Co. (D-L)
Murphy Varnish Co. (V-L-E-D)
National Copper Paint Co.
No. Bergen Paint & Varnish Co. (P-V-L-E)
Permatex Co., Inc.
Perry-Austin Mfg. Co. (P-D-L)
Phoenix Aircraft Products Co. (L-D)
Pittsburgh Plate Glass Co. (P-D-V-L)
Pratt & Lambert, Inc. (P-D-V-L-E)
Randolph Fnshg. Prod. (P-D-L)
Rinshed Mason Co. (L)
Seibert Varnish Co. (P-E)
Sewall Paint & Varnish Co. (P)
Sherwin-Williams (P-D-V-L-E)
Steelcote Mfg. Co. (E-L-P-V)
Technical Coatings, Inc.
Thresher Varnish Co. (V-L-E)
Titanine, Inc. (D-E-V-L)
Valentine & Co. (P-V)
Wailes Dove-Hermiston Corp.

PISTONS
Aluminum Industries, Inc.
Bohn Aluminum & Brass Corp.
Ohio Piston Company
Sealed Power Corp.
Tsungani Piston Co.

PISTON PINS
Aluminum Industries, Inc.
Burgess Norton Mfg. Co.
Ex-Cell-O Aircraft & Tool Corp.
Indiana Gear Works
Jadson Motor Products Co.
Marquette Metal Products Co.
McQuay-Norris Mfg. Co.
Ohio Piston Company
Sealed Power Corporation
Thompson Products, Inc.

PISTON RINGS
Amer. Hammered Piston Ring Co.
Arrow Head Steel Products Co.
Bakelite Corporation
Burd High Compression Ring Co.
Celluloid Corporation
Insulite Company
International Piston Ring Co.
Muskegon Ring Co.
Perfect Circle Co.
Ramsey Accessories Mfg. Co.
Sealed Power Corp.
Simplex Piston Ring Sls. Co.
Superior Piston Ring Co.
U. S. Hammered Piston Ring Co.
Wilkening Mfg. Co.

PLASTICS
American Catalin Corp.
American Cyanamid Co.
Barrett Company
Carbide & Carbon Chemicals Co.
General Electric Corp.
General Plastics, Inc.
Hercules Powder Co., Inc.
National Tube Company
Resinox Corporation
Tennessee Eastman Corp.
Thiokol Corporation
Unyte Corporation

Glass & Transparent Sheet

Aircraft Steel & Supply Co.
American Window Glass Co.
DuPont Viscoloid Co., Inc.
Fiberloid Corporation
Lewis St. Glass Company
Libbey-Owens-Ford Glass Co.
Nixon Nitration Works
Pittsburgh Plate Glass Co.
Protecto Safety Glass Co.
Rohm & Haas Company
Saftee Glass Company

Rubber Utilities

American Hard Rubber Co.
Blocksom & Company
Bloxham Aero Mfg. Co.
Continental Rubber Works
Firestone Tire & Rubber Co.
General Tire & Rubber Co.
Goodall Rubber Company
B. F. Goodrich Company
Goodyear Tire & Rubber Co.
Lord Manufacturing Co.
Mishawaka Rubber & Woolen Co.
Nicholas-Beazley Airplane Co.
Ohio Rubber Company
Philpott Rubber Company
Raybestos-Manhattan, Inc.
Rubatex Products, Inc.
Rubbercraft Corp. of Cal., Ltd.
Sun Rubber Company
United States Rubber Prod., Inc.
Weatherhead Company

PULLEYS
Formica Insulation Company
Molded Insulation Company
Westinghouse Elec. & Mfg. Co.

PUMPS
Rodney B. Campbell & Co.
Evans Appliance Co.
Jones Motrola Co.
Lumkenheimer Co.
Pump Eng. Service Corp.
Romec Pump Co.

SHEET PACKING
Eureka Packing Co.
Garlock Packing Co.
Vellumoid Company
Victor Mfg. & Gasket Co.

SHIELDING
Air Associates, Inc.
Breeze Corporations, Inc.
Engle Aircraft Specialties
General Cable Corp.
Scintilla Magneto Co., Inc.
Seamlex Corp.
Titeflex Metal Hose Co.

SPRINGS
Advance Spring & Wire Co.
Airplane Spring Company
American Locomotive Co.
American Steel & Wire Co.
Atlantic Spring Mfg. Co.
Barnes-Gibson-Raymond, Inc.
California Spring Company
Cary Spring Works, Inc.
Chicago Coil Spring Co.
Cleveland Wire Spring Co.
Cuyahoga Spring Co.
Charles Fischer Spring Co.
George A. Hebb Company
W. B. Jones Spring Co.
Kline Spring Company
Lee Spring Company
Los Angeles Spring Co.
Miller & Van Winkle
Phoenix Specialty Mfg. Co.
Railway Steel Spring Co.
Thomas Wire & Spring Co.
Wichita Wire Products Co.
Yost Superior Company
L. A. Young Spring Co.

STAMPINGS
Aluminum Co. of America
V. A. Boker & Sons
Detroit Stamping Co.
Garrison Engineering Co.
Otto Konigslow Mfg. Co.
Quadriga Mfg. Company
Raymond Mfg. Company
Whitehead Stamping Company
Worcester Pressed Steel Co.
Worcester Stamped Metal Co.

STEEL AND ITS ALLOYS
(Raw Materials)
(Also see Castings and Forgings; Miscellaneous Hardware)

Bar Stock

Aero Supply Mfg. Corp.
American Steel & Wire Co.
Bethlehem Steel Co., Inc.
Carnegie-Illinois Steel Corp.
Craine-Schrage Company
Crucible Steel Company
Dickerson Steel Company
Henry Disston & Sons, Inc.
Firth-Sterling Steel Co.
Peter A. Frasse & Co.
Halcomb Steel Company
Hamilton Steel Company
Jessop Steel Co.
Joseph T. Ryerson & Son, Inc.
Republic Steel Corp.
Scully Steel Products Co.
Timken Steel & Tube Co.
U. S. Steel Corporation

Cable

Aircraft Steel & Supply Co.
American Steel & Wire Co.
Barbour-Stockwell Co.
Belden Manufacturing Co.
Hazard Wire Rope Co.
John A. Roebling's Sons Co.

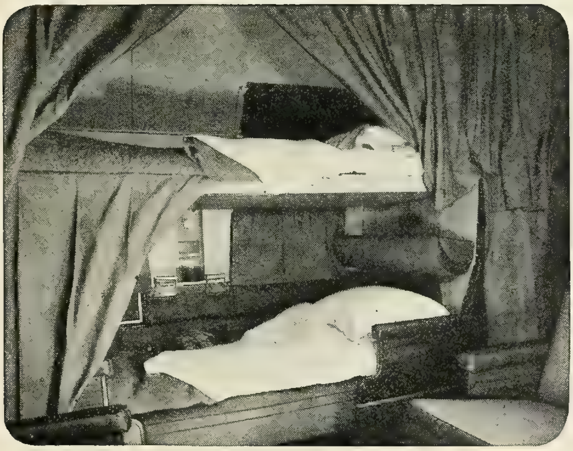
Flat Sheet

Aero Supply Mfg. Corp.
Aircraft Steel & Supply Co.
Allegheny Steel Company

(Continued on following page)

Day

Western Electric Radio Telephone flies with American Airlines



Again Western Electric is the choice—this time for American Airlines' new fleet of DST Douglas sleepers. A natural choice, too—for Western Electric 2-way radio has served American Airlines faithfully for over six years!

Every mail carrying airline in the country uses Western Electric. And more and more private flyers are installing the smaller units in their ships.

For full details, write to Western Electric, Dept. 303AD, 195 Broadway, New York.

Western Electric

Northern Electric in Canada

TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

(Cont. from preceding page)

American Rolling Mill Co.
American Sheet & Tin Plate Co.
Carnegie-Illinois Steel Corp.
Carpenter Steel Company
Central Steel & Wire Co.
Continental Steel Corp.
Crucible Steel Company
Darwin & Milner, Inc.
Peter A. Frasse & Company
Halcomb Steel Company
Hamilton Steel Company
Latrobe Electric Steel Co.
W. Leechburg Steel Company
Ludlum Steel Company
Republic Steel Corporation
Joseph T. Ryerson & Son, Inc.
Sligo Iron Store Company
Steel Sales Corporation
Superior Steel Corp.
U. S. Steel Corporation
Edgar T. Ward's Sons Co.
Wheeling Corrugating Co.
Whitehead Metal Products

Tubing

Aircraft Steel & Supply Co.
American Tube Bending Co.
Central Steel & Wire Co.
Peter A. Frasse & Co.
Hamilton Steel Co.
Michigan Seamless Tube Co.
National Tube Co.
Ohio Seamless Tube Co.
Republic Steel Corp.
Joseph T. Ryerson & Son, Inc.
Steel Sales Corporation
Summerill Tubing Company
Tubular Service Corp.

Wire

American Steel & Wire Co.
Central Steel & Wire Co.
Firth-Sterling Steel Co.
Hazard Wire Rope Co.
Republic Steel Corp.
John A. Roebling's Sons Co.
Stewart Hartshorn Co.
Tonk Brothers Company

(Fabricated Parts)

Anti-Corrosive Metal Products
Edward G. Budd Mfg. Co.
Service Steel Company

Bearings

Bantam Ball Bearing Co.
Bound Brook Oilless Bearing Co.
Fafnir Bearing Company
Federal Bearings Co., Inc.
Fischer Ball Bearing Co.
Gwilliam Company
Hyatt Roller Bearing Co.
Marlin-Rockwell Corp.
New Departure Mfg. Co.
Norma-Hoffmann Bearings Corp.
SKF Industries, Inc.
Timken Roller Bearing Co.
Torrington Company

Bushings

Amer. Non Gran Bronze Corp.
Bunting Brass & Bronze Co.
Danly Machine Specialties, Inc.
Horace T. Potts
U. S. Graphite Company

STREAMLININGS

Engle Aircraft Specialties Co.
Gem City Sheet Metal Company
Theo. Hergert, Incorporated
Hill Aircraft Streamliners Co.
Kirkham Eng. & Mfg. Corp.
Magosy & Buscher
Nicholas-Beazley Airplane Co.
Stearman Aircraft Co.

TANKS

Aluminum Co. of America
Andrews Steel Co.
Brewster Aeronautical Corp.
Ducommon Corp.
Fleetwings, Inc.
Hill Aircraft Streamliners Co.
Paramount Welded Aluminum Products Corp.
Stearman Aircraft Corp.

TIE RODS

Breeze Corporations, Inc.
MacWhyte Company
Stewart Hartshorn, Inc.

VALVES

Aluminum Industries, Inc.
Fulton Sylphon Co.
Imperial Brass Mfg. Co.
Jadson Motor Products Co.
Parker Appliance Co.
Rich Mfg. Company
Thompson Products, Inc.
United Aircraft Products, Inc.
Wilcox Rich Corporation

VALVE GUIDES

Amer. Non Gran Bronze Corp.
Ex-Cell-O Aircraft & Tool Co.
Indiana Gear Works
Tumen Bearing Co.
Shenango-Penn Molding Co.

VALVE SEATS & INSERTS

American Brass Co.
Bohn Aluminum & Bronze Corp.
Burd High Compression Ring Co.
Govro-Nelson Co.
Jadson Motor Products Co.
Lumen Bearing Co.
Steel Sales Co.
Thompson Products, Inc.
Wilcox-Rich Corp.

WOOD AND PLYWOOD

Air Associates, Inc.
Aircraft Steel & Supply Co.
Algoma Plywood & Veneer Co.
American Hardwood Lumber Co.
Atlantic Lumber Company
D. L. Auld Company
Balsa Wood Company
E. K. Bishop Lumber Co.
California Panel & Veneer Co.
Carrom Company
Central Panel & Supply Co.
Fessenden Hall
Cross, Austin, Island Lumber Co.
Haskelite Mfg. Corporation
Indiana Veneer & Panel Co.
W. Megin Lumber Company
Met-L-Wood Corporation
National Aircraft Materials Corp.
New Jersey Veneer Co.
Pacific Lumber Agency
F. Paxton Lumber Co.
Pike-Dial Lumber Company
Port Orford Cedar Products Co.
Posey Mfg. Company
Pyratone Products Corp.
Roddis Lumber & Veneer Co.
Sitka Spruce Lumber Co., Ltd.
E. J. Stanton & Sons
U. S. Plywood Company
Weyerhauser Forest Products
Woodcraft Corporation
Yoho & Hooker

ZINC

Belmont Smelting & Refining Wks.
New Jersey Zinc Sales Co., Inc.

Manufacturers of Fabricated Parts and Aircraft Materials

(For explanation of Symbols * and †, see note on page 68)

A

Abegg & Reinhold Company
Los Angeles, California
Parts:
Hardened and ground parts.

Acme White Lead & Color Works,
Detroit, Michigan
Materials:
Enamels.

Adex Manufacturing Company
604 W. Pratt St., Baltimore, Md.
Materials:
Glue. Cement.

Advance Pattern & Foundry Co.,
2734 W. 36th Place, Chicago, Ill.
E. G. Grundstrom.
Parts:
Castings (aluminum).

Advance Spring & Wire Co.,
1749-61 Carroll Ave., Chicago, Ill.
Parts:
Springs.

Aerial Machine & Tool Corp.
260 West St., New York, N. Y.
B. Kurz.
Parts:
Hardware. Cable. Casing.

Aero Supply Mfg. Corp.,
Corry, Pennsylvania
F. N. Ames, pres.; S. J. Irvine, gen. mgr.
Parts:
Hardware.
Materials:
Steel (sheet; strip; chrome molybdenum bar). Aluminum (bar; shapes). Tubing. Aluminum alloys (sheet). Wire.*

Air Associates, Inc.,
Roosevelt Field, Garden City, N. Y.
F. Leroy Hill, pres. and gen. mgr.; H. I. Crow, sec., treas., gen. sales mgr.; F. W. Bohling, mgr. manufacturers sales; Ray Acre, Chicago, mgr.; J. L. Adams, asst. Chicago mgr.; Ted Lynn, Western Branch mgr.; Ed. Burke, Western Division sales mgr.
Branch offices:
5300 W. 63 St., Chicago; 1200 Airway, Glendale.
Parts:
Radio shielding. Aircraft hardware. Propeller brakes. Wood (spruce).*†

Aircraft Steel & Supply Co.,
528-530 W. Douglas, Wichita, Kans.
O. W. Wortman, pres.; J. S. Wright, pilot and representative.
Parts:
Control cable. Hard wire.
Materials:
Steel tubing. Steel (strip; stainless sheet). Wire (round edge flat). Aluminum (sheet; rod; tube). Fabric. Plywood. Pyralin.

Airplane Spring Co.,
30 Main St., Brooklyn, N. Y.
Parts:
Springs.

Ajax Metal Company
Philadelphia, Pennsylvania
Materials:
Bronze Ingot.

Algoma Plywood & Veneer Co.,
Algoma, Wisconsin
M. W. Perry, pres.; W. E. Perry, vice-pres. and gen. mgr.; G. H. Bechhold, sec.; J. R. Fitzpatrick, sales eng.
Branch offices:
Chicago; Detroit; Cleveland; Cincinnati.
Materials:
Plywood.

Allbestos Corp.,
Germantown, Pennsylvania
Materials:
Asbestos.

Allison Engineering Co.,
Indianapolis, Indiana
N. H. Gilman, gen. mgr.
Parts:
Bearings.

Allegheny Steel Co.,
Brackenridge, Pennsylvania
W. J. McArdle, gen. sales mgr.
Materials:
Steel (stainless sheet).

Alloys & Products, Inc.
Oak Pt. Ave., New York, N. Y.
Materials:
Bronze Ingot.

Aluminum Co. of America, Inc.,
Pittsburgh, Pennsylvania
Branch offices:
90 State St., Albany; Rhodes-Haverty Bldg., Atlanta; 20 Providence St., Park Square, Boston; 1880 Elmwood Ave., Buffalo; 520 N. Michigan Ave., Chicago; Times Star Bldg., Cincinnati; 2210 Harvard Ave., Cleveland; 3311 Dunn Rd., Detroit; Boston Post Rd., Fairfield, Conn.; Capitol Bldg., 410 Asylum St., Hartford; Merchants Bank Bldg., Indianapolis; Power & Light Bldg., Kansas City, Mo.; 1031 S. Broadway, Los Angeles; 735 N. Water St., Milwaukee; Northwestern Bank Bldg., Minneapolis; Academy Bldg., Newark; American Bank Bldg., New Orleans; 230 Park Ave., New York; Fidelity-Philadelphia Trust Bldg., Philadelphia; Rialto Bldg., San Francisco; Boatmen's Bank Bldg., St. Louis; White Bldg., Seattle; Ohio Bank Bldg., Toledo; Southern Bldg., Washington, D. C.
Parts:
Aluminum castings. Aluminum forgings.
Materials:
Aluminum and aluminum alloys (sheet [coiled, flat]; plate; rod; wire; bar; foil; extruded shapes; tubing [round, square, rectangular, special shapes]; electrical conductor; fittings; rivets; impact extrusion products; Alclad [sheet, coiled, flat]); *Alcoa Albron* (powder and paste for aluminum paint). Fuel tanks. Ingot.

Aluminum Industries, Inc.,
2416 Beekman St., Cincinnati, O.
H. J. Hatter, vice-pres. and gen. mgr.; J. P. Andrae, vice-pres. in charge aeronautical sales; M. A. Beckmann, chief eng.; B. J. Plumley, district sales mgr. (Detroit).
Branch engineering and sales office:
Fisher Bldg., Detroit.
Service branches:
431 Peachtree St., Atlanta; 1923 S. Wabash Ave., Chicago; 2033 Commerce St., Dallas; 477 Selden Ave., Detroit; 1617 McGee St., Kansas City, Mo.; 1146 So. Olive St., Los Angeles; 160 W. 62 St., New York; 316 N. W. 12 Ave., Portland, Ore.; Cooper & 33 Ave. N., St. Cloud, Minn.; 731 Polk St., San Francisco; 83 Rue Lamoriniere, Antwerp, Belgium. Permite Products of Canada, Ltd., 43 Britain St., Toronto.
Parts:
Pistons (*Permite* aluminum alloy). Valves (*Permite* diachrome and steel). *Permite* piston pins. *Permite* torque pins. *Permite* aluminum hinge bearings.

The American Brass Co.
(American Metal Hose Branch)
P. O. Box 791, Waterbury, Conn.
C. S. Hungerford, vice-pres.; J. L. Vaill, supt.; W. B. Pickard, mgr.; J. G. Maxwell, chief eng.; E. T. Candee, technical supervisor; W. S. Edwards, purchasing agent; C. E. Woodward, sales promotion mgr.
Branch offices:
25 Broadway, New York; 1326 W. Washington Blvd., Chicago; 2906 Chester Ave., Cleveland.
Parts:
Flexible aluminum conduit (Navy spec.). Radio shielding. Flexible exhaust tubing. Flexible aluminum air ducts. Seamless flexible metal tubing for fuel and oil lines.

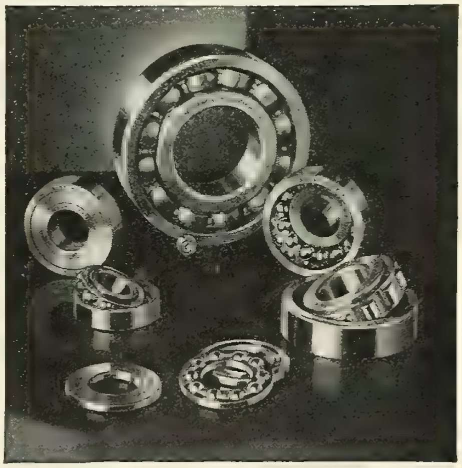
(Continued on following page)

THE
DOUGLAS "DST"
SLEEPER

IS EQUIPPED WITH
"NORMA-HOFFMANN"
PRECISION BEARINGS

This giant transport—America's largest land plane—combines the best of aviation engineering talent, with the united experience of five great airlines. It embodies all that the world of aviation can afford, as contributing to safety and serviceability.

It is natural, therefore, to find NORMA-HOFFMANN PRECISION BEARINGS employed extensively throughout the plane and its equipment. *Where the bearings must not fail*—on land, at sea, or in the air—NORMA-HOFFMANN PRECISION BEARINGS are the choice of engineers and designers of planes, engines (including superchargers), engine accessories, control apparatus, instruments, radio equipment, cameras and landing field equipment.



There are 108 distinct series in the NORMA-HOFFMANN line—PRECISION Ball, Roller and Thrust Bearings for practically every load, speed and duty in aviation work.

Write for the new Aircraft Bearings Catalog.
Let our engineers work with you.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

PRECISION BALL, ROLLER, AND THRUST BEARINGS

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

American Catalin Corporation
1 Park Ave., New York, N. Y.
Materials:
Plastics (phenolic, *Catalin*).

American Chemical Paint Co.
Ambler, Pennsylvania
Materials:
Finishes.

American Cyanamid Company
New York, New York
W. B. Bell, pres.
Materials:
Plastics (*Rezyls* and *Teglois*).

American Enameled Magnetic Wire Co.
3529 24th St., Port Huron, Mich.
Materials:
Wire.

American Felt Company
315 Fourth Ave., New York, N. Y.
J. T. Lawless, pres.; G. W. Gay, treas.; J. F. Marshall, gen. sales mgr.
Factories:
City Mills, Mass.; Franklin, Mass.; Glenville, Conn.; Rahway, N. J.; Newburgh, N. Y.; Port Chester, N. Y.; Detroit.
Branch offices:
213 Congress St., Boston; 121 N. Wacker Dr., Chicago; 197 Scotten Ave., Detroit; Ninth Vincent Bldg., Cleveland.; Drexel Bldg., Philadelphia; 451 E. Third St., Los Angeles; 309 Minna St., San Francisco; 2737 First Ave. So., Seattle; 305 N. W. 12 St., Portland, Ore.; 1629 Locust St., St. Louis.
Materials:
Felt (soundproofing, oil lubricating, sealing; packing; vibration deadening).

American Forge Company
2621 S. Hayne Ave., Chicago, Ill.
Parts:
Forgings (steel).

American Forge Works,
1428 13th Street, Denver, Colo.
Parts:
Forgings (steel).

American Hair & Felt Co.
Merchandise Mart, Chicago, Ill.
T. Welde, pres.; L. C. Scott, vice-pres.; J. J. Hagans, sec.; N. S. McKaye, treas.; John W. Perry, gen. sales mgr.
Materials:
Insulation.

American Hammered Piston Ring Company, Baltimore, Maryland
Parts:
Piston rings.

American Hard Rubber Co.
11 Mercer St., New York, N. Y.
Materials:
Rubber.

American Hardwood Lumber Co.
Los Angeles, California
Materials:
Wood.

American Locomotive Co. (Railway Spring Div.)
30 Church St., New York, N. Y.
W. C. Dickerman, pres.; J. Davis, executive vice-pres.; J. B. Ennis, vice-pres. of eng.; D. W. Fraser, vice-pres. of mfg.; F. J. Foley, vice-pres. of sales; J. D. Finn, sec.; J. O. Hobby, treas.
Parts:
Springs.

American Oak Leather Co.,
Cincinnati, Ohio
W. H. Mooney, pres.; E. L. Neilson, vice-pres.; J. B. Mantle, sec.-treas.; A. C. Utrecht, production mgr.
Factories:
Cincinnati; Louisville.
Branch offices:
354 Congress St., Boston; 350 W. Ontrio St., Chicago; 1608 Locust St., St. Louis.
Materials:
Leather (cabin and cockpit upholstery).

The American Rolling Mill Co.
Middletown, Ohio
Chas. R. Hook, pres.; Bennett Chapple, Sr., vice-pres. & dir. pub.; Calvin Verity, vice-pres. & gen. mgr.; G. F. Ahlbrandt, gen. sales mgr.
Materials:
Armco Ingot iron. Steel (sheets of special analysis).

American Screw Company
21 Stevens, Providence, R. I.
Samuel M. Nicholson, pres.; Paul C. Nicholson, vice-pres.; Eugene E. Clark, vice-pres. & gen. mgr.; Ernest I. Cassda, sec.; Albert B. Peck, sales mgr.
Parts:
Screws. Bolts.

American Sheet & Tin Plate Co. (Div. U. S. Steel Corp.), Pittsburgh, Pa.
H. V. Jamison.
Materials:
Steel (stainless parts).

American Magnesium Corp.
Cleveland, Ohio
W. G. Harvey, sales mgr.
Branch offices:
See Aluminum Company of America (sales organization).
Parts:
Castings (magnesium alloys; sand; die). Extruded shapes and rod.
Materials:
Rolled sheet magnesium alloy.

American Non Gran Bronze Corp.
Berwyn, Pennsylvania
P. E. Guckes.
Parts:
Valve guides. Bearings. Tappet guides. Bushings (steel).

American Steel and Wire Company
208 S. LaSalle St., Chicago, Ill.
(Cleveland office) C. F. Blackmer, pres.; C. F. Hood, vice-pres.; A. F. Allen, sec.-treas.; F. E. Chesney, purchasing agent. (Chicago office) D. A. Merriman, vice-pres. & gen. mgr. of sales; W. A. Cordes, advertising mgr.; C. F. Wiley, mgr. (Worcester, Mass.) John May, ass't. gen. mgr. of sales. (New York) A. H. Mowry, mgr. (Baltimore) G. H. Mackelcan, mgr. (Boston) H. D. Sharp, mgr.
Branch offices:
101 Marietta St., Atlanta; First National Bank Bldg., Baltimore; Brown-Marx Bldg., Birmingham; Statler Bldg., Boston; Liberty Bank Bldg., Buffalo; Union Trust Bldg., Cincinnati; Rockefeller Bldg., Cleveland; Praetorian Bldg., Dallas; First National Bank Bldg., Denver; General Motors Bldg., Detroit; 417 Grand Ave., Kansas City, Mo.; Sterick Bldg., Memphis; Bankers Bldg., Milwaukee; First National Bank Bldg., St. Paul; Empire State Bldg., New York; Ramsey Tower, Oklahoma City; Broad St. Station Bldg., Philadelphia; Frick Bldg., Pittsburgh; Walker Bank Bldg., Salt Lake City; 506 Olive St., St. Louis; Miners Bank Bldg., Wilkes-Barre; 94 Grove St., Worcester, Mass. Columbia Steel Co. (Pacific Coast Distributors) Russ Bldg., San Francisco; 2087 E. Slauson Ave., Los Angeles; 2345 N. W. Nicolai St., Portland, Ore.; 1054-4 Ave. S., Seattle; Petroleum Bldg., Houston.
Parts:
Wire (electrical; spring; welding). Strand and cord (tin; galvanized; stainless steel). Cable (electrical; ignition; lighting; starting).
Materials:
Steel (*USS* stainless cold rolled strip; cold finished bar and wire).

American Tube Bending Co., Inc.
5 Lawrence St., New Haven, Conn.
R. H. Wulf, pres.; N. C. Wellman, vice-pres.; E. L. Wulf., sec.; J. L. Umsteadt, supt.
Parts:
Steel, brass, copper, aluminum and aluminum alloy tubular parts (intake pipes; oil lines; ignition cable tubes; exhaust collectors; exhaust stacks).

American Window Glass Company
Farmer Bank Bldg., Pittsburgh, Pa.
E. D. Mason.
Materials:
Windshield and enclosure material. Cabin glass.

Anderson Flax Fiber Company, Inc.
39 Niagara St., Buffalo, New York
H. G. Anderson, pres.; A. M. Anderson, vice-pres.; L. E. Jordan, sec.
Materials:
(Distributors) Leather. Insulating and soundproofing (curled hair; *Kapoc*; fibre; cotton batting; felt).

Anti-Corrosive Metal Products
Castleton-on-Hudson, N. Y.
Parts:
Stainless steel parts.

Apex Machine & Tool Co.
Dayton, Ohio
Carl A. Lange, sales mgr.
Parts:
Hardware (*Universal* joints).

Arbeka Webbing Company
Pawtucket, Rhode Island
John Howe, mgr.
Materials:
Tapes (fabric).

Armstrong Cork Company
Lancaster, Pennsylvania
S. E. Conybeare, gen. mgr.; F. E. Stevens, ass't. gen. mgr.
Factories:
Lancaster, Pittsburgh and Beaver Falls, Pa.; Camden, N. J.
Materials:
Cork (sheet; gaskets; catwalk facing; flooring; wall finish).

Arrow Head Steel Products Co.
Stinson Blvd., Minneapolis, Minn.
F. C. Bahr, pres.; W. C. Wilson, adv. mgr.
Parts:
Piston rings.

Atlantic Lumber Company
Boston, Massachusetts
Materials:
Wood (maple; ash; cherry; birch).

Atlantic-Pacific Mfg. Co.
124 Atlantic Ave., Brooklyn, N. Y.
Materials:
Cork.

Atlantic Spring Mfg.
Philadelphia, Pennsylvania
Parts:
Springs.

Atlas Drop Forge Co.
Lansing, Michigan
Parts:
Forgings (steel).

Atlas Steel Casting Co.
Black Rock Station, Buffalo, N. Y.
Parts:
Castings (steel).

Atlas Tack Corporation
Fairhaven, Massachusetts
J. H. Adair, chairman of board; R. G. Edwards, pres. & gen. sales mgr.; J. A. M. Adair, vice-pres.; E. Jayerm, works mgr.; F. Grant, purchasing agent.
Parts:
Miscellaneous hardware (escutcheon pins [brass; iron; other metals]; eyelets [brass; aluminum; zinc]; grommets [brass; aluminum; zinc]; finishing washers [brass, countersunk and flush; aluminum, countersunk and flush]; nails [*Metaleather* upholstering; cut; wire; inside wiring]; rivets [copper, brass, aluminum]; burrs [steel, copper, aluminum, brass]; staples; tacks [aluminum, brass, bronze, copper, iron, Monel]; tufting buttons).

D. L. Auld Co., Columbus, Ohio
William Mackay.
Materials:
Wood. Plywood.

B

Bakelite Corporation
247 Park Avenue, New York, N. Y.
Gordon Brown, sales mgr.
Materials:
Bakelite (molded; laminated; cast resins). Heat hardenable varnish. Enamel. Lacquer. Cement.

Balsa Wood Corp.
158 Pioneer St., Brooklyn, N. Y.
Joseph T. Downey.
Materials:
Balsa wood.

Bantam Ball Bearing Co.
South Bend, Indiana
J. F. Oelhoffen, sales mgr.
Branch offices:
Hartford; New York; Rochester; Philadelphia; Pittsburgh; Washington, D. C.; Cleveland; Toledo; Detroit; Indianapolis; Chicago; Milwaukee.
Parts:
Bearings (needle; ball; quill; roller).

Barbour-Stockwell Co.
205 Broadway, Cambridge, Mass.
E. D. Ryer.
Parts:
Cable.

Barnes-Gibson-Raymond, Inc.
6400 Miller Ave., Detroit, Mich.
L. D. Adams, pres.; F. M. Raymond, vice-pres.; Wm. M. Marr, treas.; Wm. J. Black, sales mgr. (Corry) F. E. Whittlesey, gen. mgr.; J. E. Mount, sales mgr. (Chicago) E. C. Spal, sales mgr. (Bristol) H. B. Reid; Fuller F. Barnes.
Branch offices:
W. D. Gibson Company, 1800 Clybourn Ave., Chicago, Ill.; Raymond Manufacturing Co., Corry, Pa.; Wallace Barnes Company, Bristol, Conn.
Parts:
Springs.

Barrett Company
40 Rector St., New York, N. Y.
E. W. Clark, pres.; A. L. Loebenberg, vice-pres.; R. L. Commann, dir. sales; E. R. Snyder, gen. mgr.
Materials:
Plastics (*Cumar*).

Bearium Metals Corporation
258 State St., Rochester, N. Y.
E. P. Langworthy, pres. & gen. mgr.; Dr. H. M. Rees, vice-pres.
Branch offices:
113 S. Jefferson St., Chicago, Ill.
Parts:
Castings (bronze alloy; copper alloy).

Belden Manufacturing Co.
4647 W. Van Buren, Chicago, Ill.
H. W. Clough.
Parts:
Cable (steel).

Belmont Smelting & Refining Works, Inc.
328 Belmont Ave., Brooklyn, N. Y.
Materials:
Antimony. Bar tin. Copper nickel shot. Lead. Metallic Silicon. Nickel alloy. Zinc.

Bernitz Manufacturing Co.
1400 Oak St., Kansas City, Mo.
Parts:
Hardware (brass).

Berry Brothers
211 Leib St., Detroit, Michigan
J. B. Bond, executive vice-pres.; T. B. Colby, vice-pres. & aviation mgr.; F. D. Klein, chemist; W. F. Bartz, production mgr.
Factories:
Detroit; Baltimore; Walkerville, Ont., Canada.
Branch offices:
129-26 St., Brooklyn, N. Y.; 21 Power House St., Boston; Delaware Ave. & Tasker St., Philadelphia; 300 West Hubbard St., Chicago; 130 West Court St., Cincinnati; 6513 Page Ave., St. Louis.
Materials:
Berryloid Dope (clear; pigmented). Thinner. Paint. Enamel. Lacquer. Varnish. Primer (zinc chromate).

Bethlehem Steel Co., Inc.
Bethlehem, Pennsylvania
H. G. Walton, gen. mgr. of sales.
Branch offices:
In all principal cities.
Parts:
Forgings (drop and hammer for crankshafts; connecting rods; camshafts; rocker arms, gears).

(*Continued on following page*)

WINGS OVER MOHAIR

Beechcraft plane upholstered in "Pisa" quality Velmo.

EASTERN AIR LINES...WACO...BEECHCRAFT... one by one the aircraft companies are recognizing the superiority of mohair velvet for transportation upholstery, as the railroads and motor cars have done for years.

This rich mohair velvet has one special quality for planes...it is *sound absorbing*. It definitely blankets noise as no hard-surface fabric can. It is easy on clothing, easy to clean, luxurious to the touch but hard to wear out. Years and miles of service in transportation have proved that Velmo is literally *"Good to the Last Mile!"*

VELMO

MOHAIR VELVET

A GOODALL-SANFORD PRODUCT

L. C. CHASE & COMPANY, INC.
selling division of Goodall-Sanford
295 Fifth Avenue, New York
Boston • Chicago • Detroit • San Francisco

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Materials:
Bar stock (normal carburizing; alloy; special carbon).

Bilgram Gear & Machine Works
Philadelphia, Pennsylvania
Parts:
Gears.

Billings & Spencer Company
1 Laurel, Hartford, Conn.
W. Roy Moore, vice-pres. & gen. mgr.; H. H. Cleveland, gen. sales mgr.
Parts:
Gears. Forgings (steel).

E. K. Bishop Lumber Co.
Aberdeen, Washington
Materials:
Spruce.

Blanchard & Lane, Newark, N. J.
S. B. Gay.
Materials:
Upholstery (leather).

Blocksom & Company
Michigan City, Indiana
B. H. Blocksom.
Materials:
Rubberized hair for upholstery.

Bloxham Aero Manufacturing Co.
7541 Emerald Ave., Chicago, Ill.
Materials:
Rubber utilities.

Sidney Blumenthal & Co.
1 Park Ave., New York, N. Y.
G. B. Matthews.
Materials:
Drapery. Carpets.

Bohn Aluminum & Brass Corp.
Lafayette Bldg., Detroit, Mich.
C. E. Bohn.
Parts:
Cylinder heads. Crankcases. Pistons. Castings (aluminum). Extruded shapes (aluminum). Valve seats.

V. A. Boker & Sons
Minneapolis, Minn.
V. A. Boker, pres.
Parts:
Stampings (parts fabricated to specifications for aircraft and radios).

Bonney Forge & Tool Works
Allentown, Pa.
F. S. Durham, pres.; J. E. Durham, Jr., vice-pres.; F. S. Durham, gen. sales mgr.; J. E. Durham, gen. mgr.
Parts:
Forgings.

Booth Felt Co., Inc., Brooklyn, N. Y.
E. W. Booth, treas.; (Chicago) L. D. Croninger, mgr.
Branch offices:
Chicago.
Parts:
Felt (fuel and oil tank pads; rocker box valve covers; propeller hub rings).
Materials:
Felt (insulation).

Boston Gear Works, Quincy, Mass.
E. K. Johnston.
Parts:
Gears.

Boston Insulated Wire & Cable Co.
65 Bay St., Dorchester, Mass.
Materials:
Insulated wire and cable.

Brass & Copper Sales
2817 Laclede Ave., St. Louis, Mo.
Parts:
Fuel line tubing.

Bound Brook Oilless Bearing Co.
Bound Brook, New Jersey
Parts:
Bearings. (*Compo* self-lubricating; *Bound Brook* graphite [bronze]; *Nigrum* impregnated wood).

Breeze Corporations, Inc.
24 South Sixth St., Newark, N. J.
J. J. Mascuch, pres.; J. T. Mascuch, sec.-treas.; J. F. Lucas, sales mgr.; M. C. Healy, ass't. sec.-treas.; S. H. Roberts, production mgr.; F. G. Gardner and M. M. Eells, aircraft engineers.
Parts:
Flexible shielded conduit (Army and Navy type). Hardware. Radio ignition shielding. Tie rods. Assemblies (conduit; tab control; remote control). Tachometer drives. Fittings. Electric connectors.*

Brewster Aeronautical Corp.
Long Island City, New York
J. Work, pres.; D. T. Brown, chief eng.; P. M. Stephenson, works mgr.; J. R. Hunt, sec.-treas.
Parts:
Exhaust manifolds (stainless steel). Aluminum alloy parts (engine ring cowls; cylinder head deflectors; firewalls; pilot's seats; radio tables; ammunition boxes; flotation gear containers). Fuel and oil tanks (aluminum alloy).*

Brooklyn Varnish Mfg. Co.
35 Nostrand Ave., Brooklyn, N. Y.
Materials:
Paint (bakelite primers and color coat).

Brown & Sharpe Mfg. Co.
Providence, Rhode Island
H. B. Shott.
Parts:
Cylinder barrels. Gears.

Edward G. Budd Mfg. Co.
Philadelphia, Pennsylvania
Edward G. Budd, pres.; Donald Alexander, vice-pres. and gen. sales mgr.; Edward G. Budd, Jr., vice-pres. and gen. mgr.
Parts:
Stainless steel parts.

Buffalo Machine Key Co.
62 Clyde Ave., Buffalo, N. Y.
Parts:
Hardware (taper pins).

Buhl Stamping Company
Detroit, Michigan
H. Finkenstaedt, pres.
Parts:
Exhaust manifolds.

The Bunting Brass & Bronze Co.
Toledo, Ohio
Branch offices:
New York; Chicago; San Francisco; Boston; Cleveland; Detroit; Los Angeles; Seattle; Dallas; Brooklyn, N. Y.; Kansas City, Mo.; Cincinnati; Philadelphia; St. Louis; Minneapolis; Milwaukee; Newark; Atlanta.
Parts:
Bushings. Bearings. Washers (bronze). Castings (bronze).
Materials:
Bronze (bar).

Burd High Compression Ring Co.
Rockford, Illinois
F. M. White, pres.
Parts:
Valve seats. Piston rings.

Burgess Norton Mfg. Co.
521 Peyton St., Geneva, Ill.
Parts:
Piston pins. Link pins.

C

California Panel & Veneer Co.
Los Angeles, California
R. Mulholland.
Materials:
Plywood.

California Spring Company
Los Angeles, California
Parts:
Springs.

Camden Forging Company
Camden, New Jersey
Parts:
Forgings (steel).

Camel Lead Color and Chemical Products Manufacturing Co.
33-35 Keap St., Brooklyn, N. Y.
I. Wexler, pres.
Materials:
Finishes.

Rodney B. Campbell & Co.
Los Angeles, California
Parts:
Pumps (hydraulic).

Canton Drop Forging & Mfg. Co.
Willett Ave., S. E., Canton, Ohio
C. A. Brauchler, pres. & gen. mgr.; K. S. Goodin, sec.
Parts:
Forgings. Cylinder barrels. Camshafts. Propeller hubs. Crankshafts. Connecting rods. Gears.

Carbide & Carbon Chemicals Corp.
30 E. 42nd St., New York, N. Y.
J. A. Rafferty, pres.; W. F. Reich, Jr., gen. sales mgr.; H. S. Runn, sales mgr.
Materials:
Plastics (*Vinylete*).

Carnegie-Illinois Steel Corp. (Div. U. S. Steel Corp.), Pittsburgh, Pa.
B. F. Fairless, pres.; C. V. McKaig, vice-pres. and gen. mgr. of sales.
Materials:
Steel (bar; sheet).

George A. Carpenter, Chicago, Ill.
Materials:
Carpets.

The Carpenter Steel Company
Reading, Pennsylvania
Branch offices:
Chicago; Cleveland; Detroit; Hartford; Indianapolis; Milwaukee; New York; Philadelphia; Providence; Rochester, N. Y.; St. Louis; Springfield, Mass. Branch warehouses: Chicago, Cleveland, Detroit, Hartford, Indianapolis, St. Louis.
Materials:
Steel and steel alloys (chrome nickel; nickel steel; stainless; chrome ball; chrome-vanadium; chrome molybdenum).

The Carrom Co., Ludington, Mich.
Materials:
Plywood.

Cary Spring Works, Inc.
240 W. 29th St., New York, N. Y.
Parts:
Springs.

Casein Mfg. Co. of America, Inc.
350 Madison Ave., New York, N. Y.
William Callan, pres.; W. F. Leicester, vice-pres. and sales mgr.
Factory:
Bainbridge, N. Y.
Materials:
Glue (*Casco* waterproof).

Celluloid Corp., Newark, N. J.
Materials:
Transparent sheet (*Pyralin*).

Central Panel & Supply Company
110 W. Commerce St., Cincinnati, O.
Materials:
Plywood.

Central Steel & Wire Co.
4545 S. Western Blvd., Chicago, Ill.
Materials:
Steel (wire, cable tubing and sheet).

H. Channon Co., Chicago, Illinois
Materials:
Asbestos.

Champion Machine & Forge
3695 E. 78th St., Cleveland, Ohio
Parts:
Forgings (steel). Crankshafts. Camshafts. Connecting rods. Gears. Propeller hubs, and shafts. Rocker arms.

Chase Brass & Copper Co.
236 Grand, Waterbury, Conn.
F. S. Chase, pres.; R. L. Coe, vice-pres. & gen. sales mgr.; R. D. Ely, vice-pres. & production mgr.
Factories:
Waterbury, Conn.; Cleveland, O.
Branch offices:
New York; Boston; Cleveland; Cincinnati; Detroit; Chicago; Milwaukee; Pittsburgh; Philadelphia; New Orleans; Los Angeles; San Francisco; Seattle; Minneapolis; St. Louis; Newark; Baltimore, Md.; Providence.
Materials:
Brass, bronze, copper (sheet; rod; wire; tubing).

L. C. Chase
295 Fifth Ave., New York, N. Y.
Goodall Worsted Mills, Sanford, Me., E. Nutter; Sanford Mills B, Sanford, Me., R. Goodall; L. C. Chase & Co.; G. B. Ogan, 295 Fifth Ave., New York; G. Sawyer, Statler Bldg., Boston; H. Willias, 442 Post St., San Francisco; A. E. Ronninger, New Center Bldg., Detroit; R. Warren, Merchandise Mart Bldg., Chicago.
Factory:
Goodall Sanford Industries, Sanford, Me.
Branch offices (selling division):
Merchandise Mart, Chicago; New Center Bldg., Detroit; 442 Post St., San Francisco.
Materials:
Upholstery (mohair velvet *Velmo*; mohair fabric *Goodall Mohairs*; coated fabric *Leatherwove*. Carpeting (inlaid Seamloc).

Cheney & Son, Manlius, New York
J. P. Cheney, adv. mgr.
Parts:
Cylinder barrels.

Chicago Coil Spring Co.
318 N. Albany Ave., Chicago, Ill.
L. Wennerberg.
Parts:
Springs.

Chicago Curled Hair Company
Chicago, Illinois
A. N. Horwich, pres. & sales mgr.; H. G. Broeker, eng.
Factory:
286 Meserole St., Brooklyn, N. Y.
Materials:
Insulation material (*Insulex*). Hair felt.

Chicago Rawhide Mfg. Co.
1305 Elston Ave., Chicago, Ill.
Materials:
Leather.

Chicago Screw Company
1026 S. Homan Ave., Chicago, Ill.
Parts:
Nuts and bolts.

Chicago Tubing & Braiding Co.
310 N. Clinton St., Chicago, Ill.
Parts:
Flexible tubing.

Cleveland Graphite Bronze Co.
Cleveland, Ohio
Parts:
Bearings (bronze steel back).

Cleveland Tanning Company
Cleveland, Ohio
W. G. Plumer, pres.; F. R. Wilhelmy, sales mgr.
Materials:
Leather *Aerokrome* (cockpit and cabin upholstery).

Cleveland Wire Spring Co.
1281 E. 38th St., Cleveland, Ohio
J. W. Campbell, pres.
Branch offices:
General Motors Bldg., Detroit.
Parts:
Springs.

Climax Molybdenum Company
500 Fifth Ave., New York, N. Y.
Factory:
Longeloth, Pennsylvania.
Branch offices:
Canton, Ohio; Chicago; Detroit; Los Angeles; Pittsburgh.
Materials:
Molybdenum (Ferro-molybdenum; calcium molybdate).

(*Continued on following page*)

OVER 400
Constant Speed Propellers

are to be installed on these advanced types of military and naval aircraft

HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Coast Centerless Grinding
Los Angeles, California
Parts:
Hardened and ground parts.

C. R. Coffey Company
Kansas City, Missouri
Materials:
Felt.

Commonwealth Brass Corp.
Detroit, Michigan
Parts:
Fittings.

Conneaut Leather Co., Conneaut, O.
Materials:
Leather.

T. E. Conklin Brass & Copper Co.
54 Lafayette St., New York, N. Y.
Materials:
Brass. Copper.

Continental Diamond Fibre Co.
Newark, Delaware
Materials:
Fibre.

Continental Rubber Works
Erie, Pennsylvania
T. R. Palmer, pres.; Dr. P. H. Henkel, sales & gen. mgr.; H. T. Fowler, gen. sales mgr.
Parts and materials:
Rubber utilities.

Continental Steel Corp.
Kokomo, Indiana
D. A. Williams, pres.; U. K. Beeker, vice-pres. and sec.; Niles Chapman, treas.
Materials:
Sheet steel.

Cook Heat Treating Co.
Los Angeles, California
Branch offices:
3334 E. Slauson Ave., Los Angeles; 6237 Navigation Blvd., Houston.
Parts:
Hardened and ground parts (heat treating; cyaniding; normalizing; stress relieving).

Cook Paint & Varnish Co.
Kansas City, Missouri
W. S. Atkinson, mgr. aviation & railway sales.
Materials:
Paint. Dope. Finishes.

Craine-Schrage Company
Detroit, Michigan
Materials:
Steel (bar).

Cross, Austin & Ireland Lumber Co.
1246 Grand St., Brooklyn, N. Y.
Materials:
Spruce.

The Crown Cork & Seal Co.
1508 Barclay St., Baltimore, Md.
D. O. Kimball, mgr., contract machinery division.
Parts:
Metal and cork (parts and assemblies fabricated to manufacturer's specifications for aircraft, aircraft engines and armament equipment).

Crucible Steel Company
Chrysler Bldg., New York, N. Y.
J. J. Boylin.
Materials:
Steel (bar; sheet; stainless).

Cuyahoga Spring Co., Cleveland, O.
Parts:
Springs.

D

C. R. Daniels, Inc.
98 Crosby St., New York, N. Y.
Parts:
Rivets (steel).

Danly Machine Specialties, Inc.
Cicero, Illinois
Parts:
Bushings (steel).

Dardelet Threadlock Corp.
120 Broadway, New York, N. Y.
Branch offices:
205 Wacker Dr., Chicago; Book Bldg., Detroit.
Parts:
Nuts and bolts.

Darwin & Milner, Inc.
38 Park Row, New York, N. Y.
Materials:
Steel (Cobalt Chrome).

Davenport Drop Forge Co.
Davenport, Iowa
Parts:
Forgings.

Dayton-Rogers Manufacturing Co.
Minneapolis, Minnesota
Parts:
Castings (aluminum).

Dearborn Chemical Co.
310 S. Michigan Ave., Chicago, Ill.
R. F. Carr, pres.; G. R. Carr, vice-pres.; E. M. Converse, vice-pres.; F. L. Baker, sec. and treas.
Materials:
Paint.

Detroit Gasket Co., Detroit, Mich.
B. S. Brown, in charge sales.
Parts:
Gaskets (*Steelbestos*). *Duprene* and *Thiokol* products.

Detroit Screw Co., Detroit, Mich.
Parts:
Nuts. Bolts.

Detroit Stamping Company
Detroit, Michigan
G. H. Roberts, pres., gen. mgr., adv. mgr., gen. sales mgr. & purchasing agent; John Beck, vice-pres.; T. H. Roberts, sec. & treas.
Parts:
Stampings. Washers (steel; brass; copper). Shims (steel).

Diamond Chain & Mfg. Company
Indianapolis, Indiana
G. A. Wainwright, pres. and gen. mgr.; C. C. Winegardner, vice-pres.; T. M. Caswell, sec. and treas.; W. B. Haislup, gen. sales mgr.
Parts:
Roller chains. Sprockets. Flexible couplings.

Detroit Steel Casting Co.
4069 Michigan Ave., Detroit, Mich.
Parts:
Castings. Forgings.

Dibble Color Co., Detroit, Mich.
E. W. Farmer, asst. gen. mgr.
Materials:
Paint.

The Dickerson Steel Co., Dayton, O.
C. Dickerson.
Materials:
(Jobbers) chrome molybdenum bar and strip (3.5% nickel bars; SAE 1025 bar and strip; SAE 1095 strip; A & N specification alloys).

Henry Disston & Sons, Inc.
Land Title Bldg., Philadelphia, Pa.
Materials:
Steel (bar).

Dodge Cork Co., Inc., Lancaster, Pa.
Materials:
Cork.

Doehler Die Casting Co.
386 Fourth Ave., New York, N. Y.
Factories:
Toledo; Batavia, N. Y.; Pottstown, Pa.
Parts:
Die castings (brass; aluminum).

The Dole Valve Co., Chicago, Ill.
A. R. Dole, pres.; A. Dole, vice-pres.; F. H. Tweed, treas. & gen. mgr.; J. L. Dole, sec. & gen. sales mgr.
Parts:
Fittings.

Dolphin Paint & Varnish Company
Champlain & Locust Sts., Toledo, O.
Materials:
Cement.

Dow Chemical Company
Midland, Michigan
L. B. Grant, mgr., Dowmetal division.
Parts:
Dowmetal (castings; forgings; extruded shapes).
Materials:
Dowmetal (rolled; sheet).

Ducommon Corp., Los Angeles, Cal.
Parts:
Tanks (oil; gas). Copper tubing.

DuPont Viscoloid Co., Inc.
350 Fifth Avenue, New York, N. Y.
W. A. Joslyn, director of sales, Arlington, N. J.
Branch offices:
North American Bldg., Chicago; 601 Third St., San Francisco.
Materials:
Transparent sheeting (*Pyralin* and *Plastacele*). Paint. Dope. Varnish. Lacquer.*

Dry-Zero Corp., Chicago, Ill.
H. B. Lindsay, pres.; L. M. Cunningham, gen. mgr.; M. R. Easter, fact. supt.; C. H. Lindsay, chief eng.
Materials:
Soundproofing. Insulation (*Dry-Zero*).

Dzus Fastener Company
Babylon, L. I., New York
Branch office:
Thos. P. Headland, Ltd., Pearlman St., Westminster Rd., London, S. E. 1.
Parts:
Fasteners.

E

Eclipse Aviation Corporation
East Orange, New Jersey
C. Marcus, pres.; R. P. Lansing, vice-pres.; H. A. Gossner, sec.; W. J. Buettner, treas.; C. H. Knoch, ass't sec. treas.; A. E. Raabe, sales mgr. & ass't sec.
Factories:
(Foundry division) 1265 McBride Ave., Little Falls, N. J.
Parts:
Castings (magnesium alloy; aluminum alloy; bronze alloy). Engine starters (hand and electric inertia; direct cranking electric; air injection; hand turning gear). Starter accessories (accelerating motors; battery booster coils; booster magnetos; solenoid switches; push-pull switches). Engine driven generators (single voltage; double voltage radio). Filter units. Control boxes. Radio dynamotors. Vacuum instrument pumps. De-icer equipment. Automatic variable pitch propeller hub. Electric motors (landing gear; wing flaps). Fuel flowmeters (direct and remote reading). Engine synchroscope. Auxiliary gasoline engine power equipment. Hydraulic remote control. Hydraulic pumps (motor driven; engine driven). Supercharger regulators. Mixture controls. Superchargers. Flexible metallic tubing.

Eagle Ottawa Leather Co.
Grand Haven, Michigan
E. K. Ellis, sales and adv. mgr.
Materials:
Upholstery (leather).

Eastern Malleable Iron Co., Inc.
Naugatuck, Connecticut
Parts:
Castings (steel).

Egyptian Lacquer Co., N. Y., N. Y.
Frank G. Drake.
Materials:
Paints. Enamels.

Elastic Stop Nut Corp.
Elizabeth, New Jersey
A. Swanstrom, pres. & gen. mgr.; H. B. Thomas, vice-pres. & sales mgr.
Parts:
Stop nuts (steel; brass; duralumin).

Elco Tool & Screw Corp.
Rockford, Illinois
Parts:
Screws.

Ellfeldt Hardware Co.
1300 Walnut St., Kansas City, Mo.
Materials:
Fibre.

Emsco Asbestos Company
Downey, California
E. M. Smith.
Parts:
Rivets (aluminum).

Endicott Forging & Mfg. Co.
Endicott, New York
A. W. Schaefer.
Sales offices:
Syracuse; New York; Boston; Detroit; Philadelphia; Cleveland; Cincinnati.
Parts:
Forgings (steel). Camshafts. Gears.

Engel Aircraft Specialties
Escondida, California
J. H. Engel, pres.
Parts:
Streamlinings (NACA cowling; speed rings; nose spinners; wheel pants). Cooling deflectors. Exhaust manifolds. Wheels. Tank fittings. Cowlings. Exhaust rings (stainless steel; Monel metal; commercial steel).

Evans Appliance Company
Detroit, Michigan
E. S. Evans, Jr., vice-pres.
Branch offices:
90 West St., New York, N. Y. Representative, Pacific Airmotive Corp., Ltd. Union Air Terminal, Burbank, Calif.
Parts:
Pumps (fuel).

Ex-Cell-O Aircraft & Tool Corp.
1200 Oakman Blvd., Detroit, Mich.
N. A. Woodworth, pres. & gen. mgr.; Phil Huber, vice-pres. & ass't. gen. mgr.; W. F. Wise, sales mgr.
Parts:
Piston pins. Valve guides (aluminum; bronze). Precision aircraft engine parts (pump shaft; relief valves; ball ends and sockets; timing pinion bolt and washers; rollers; spacers; rocker arm axle; propeller hub nut; tachometer shaft; bushings; pump shaft; piston pin and plugs; cam followers; engine nuts and bolts).*

F

The Fafnir Bearing Co.
New Britain, Connecticut
C. F. Stanley, sales mgr.; D. L. Holbrook, sales eng. for aircraft division, in charge research and development; C. G. Rosensweig, production mgr.
Branch offices:
288 Spring St., Atlanta; 9 S. Clinton St., Chicago; Union Bldg., Cleveland; 2825 Commerce St., Dallas; New Center Bldg., Detroit; 1625 Grand Ave., Kansas City, Mo.; 1834 Broadway, New York; 3701 N. Broad St., Philadelphia; 2638 W. Lynn St., Seattle.
Parts:
Ball bearings (single row radial; single row radial thrust; straight thrust; rigid or self aligning double metal shield; rigid or self aligning double felt seal; light single row without seals).

Farrell-Birmingham Company
Ansonia, Connecticut
Parts:
Forgings.

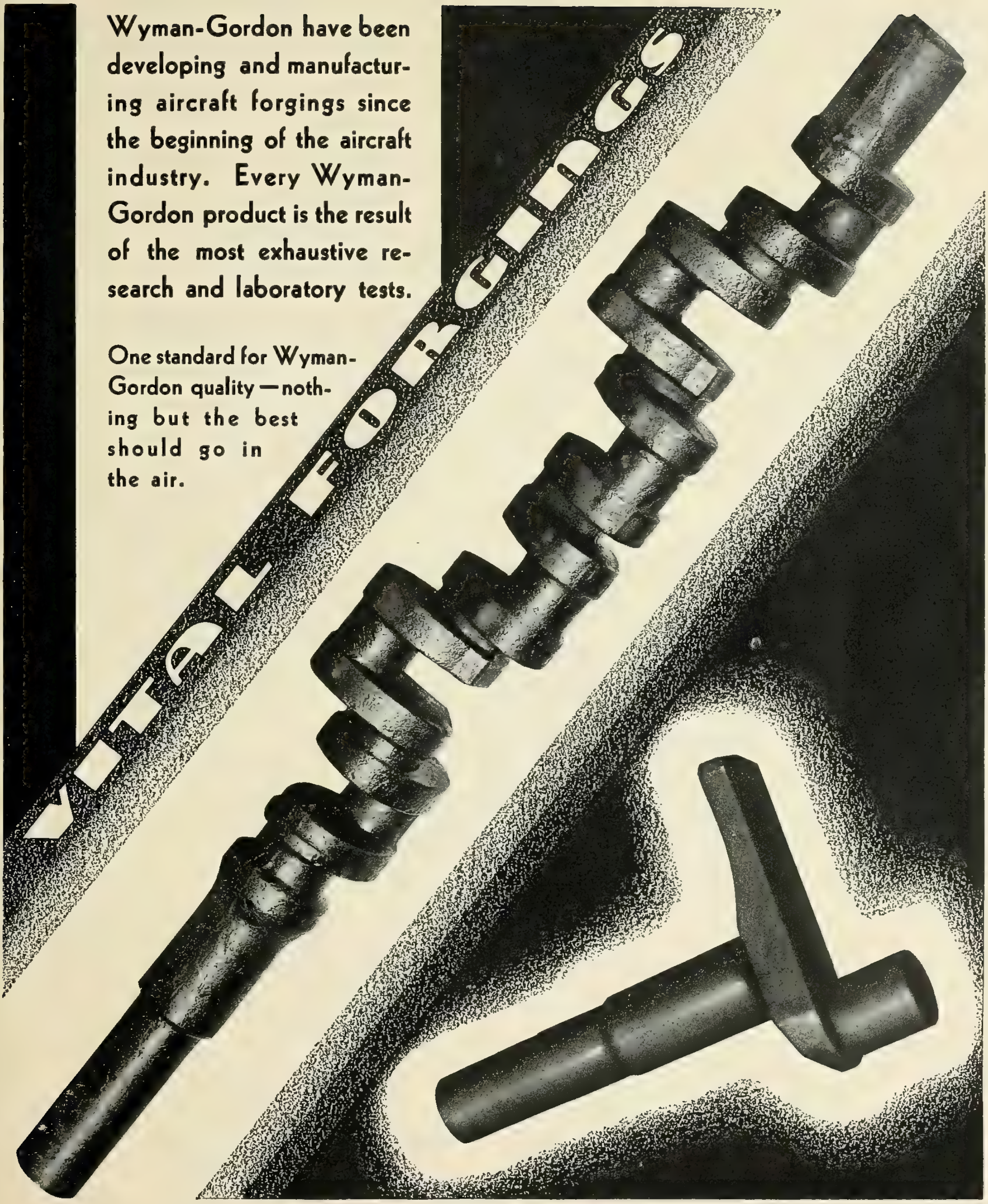
Farrell-Cheek Steel Company
Sandusky, Ohio
C. C. Hottman, sales dept.
Parts:
Castings (steel).

L. F. Fechtmans & Co.
48 E. 21st St., New York, N. Y.
Materials:
Upholstery.

(*Continued on following page*)

Wyman-Gordon have been developing and manufacturing aircraft forgings since the beginning of the aircraft industry. Every Wyman-Gordon product is the result of the most exhaustive research and laboratory tests.

One standard for Wyman-Gordon quality—nothing but the best should go in the air.



WYMAN-GORDON

WORCESTER, MASS., HARVEY, ILL., DETROIT, MICH.

"GUARANTEED FORGINGS"

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Federal Bearings Co., Inc.
Poughkeepsie, New York
H. A. Schatz, pres.; G. H. Schatz, sec.
Factory:
(Ball branch); The Waterbury Steel Ball Co., Inc., Chicago.
Branch offices:
Book Tower, Detroit; 120 N. Peoria St., Chicago.
Parts:
Ball bearings (double oil shield single row; double row; self aligning; torque tube; single row radical with and without oil shield and double oil shield: single row radical felt-lab seal; separable; self aligning double row radial).

Federal Mogul Corporation
Detroit, Michigan
D. W. Rodgers, vice-pres. & sales director; A. B. Wills, eng.
Parts:
Bushings (bronze). Bearings (steel backed cadmium alloy lined; bronze and steel backed babbitt lined; camshaft). Washers (bronze). Castings (bronze; aluminum bronze).
Materials:
Copper alloys (brass and bronze bars).

The Felters Company, Inc.
210 South St., Boston, Mass.
W. C. King, pres.; F. S. Peck, vice-pres.; L. H. Hansel, vice-pres. & treas.; G. G. Reid, ass't. treas.
Factories and mills:
Millbury, Mass.; Johnson City, N. Y.; Jackson, Mich.
Branch offices:
New York; Philadelphia; Dallas; Detroit; St. Louis; Chicago; San Francisco; Los Angeles; Cleveland.
Materials:
Felt (washers; wicks; tabs; weather-stripping; insulation; bonded metal).

L. W. Ferdinand & Co.
152 Kneeland St., Boston, Mass.
L. C. Herring.
Materials:
Glue.

Firestone Tire & Rubber Co.
Akron, Ohio
W. S. Wilson, aircraft sales mgr.; J. E. Hale, research mgr.; T. E. Pittenger, production mgr.
Factories:
1278 South Main St., Akron; 2525 Firestone Blvd., Los Angeles.
Parts and Materials:
Rubber utilities (mechanical parts; tubing).*

Fessenden Hall
Philadelphia, Pennsylvania
Materials:
Plywood.

Fiberloid Corporation
Indian Orchard, Massachusetts
Materials:
Transparent sheet.

Firth-Sterling Steel Co.
710-714 W. Lake St., Chicago, Ill.
Factory:
McKeesport, Pa.
Materials:
Stainless steel (bar; wire).

Fischer Ball Bearing Corp.
33 W. 60th St., New York, N. Y.
A. Golden, sales mgr.
Parts:
Bearings.

Charles Fischer Spring Co.
240 Kent Ave., Brooklyn, N. Y.
S. Fischer.
Parts:
Springs.

Fitzgerald Mfg. Company
Torrington, Connecticut
P. J. Fitzgerald, pres.; B. G. Peck, sales mgr. in charge adv.
Parts:
Gaskets.

Fleetwings, Incorporated
Radcliffe St., Bristol, Pa.
Carl de Ganahl, pres.; G. S. Ireland, vice-pres.; W. L. Sutton, chief eng.; A. M. Carlson, sec.-treas.
Parts:
Tanks (shotwelded stainless steel). Wing ribs. Wing beams. Control surfaces).*

Formica Insulation Co.
Cincinnati, Ohio
W. G. Steiner.
Parts:
Pulleys.
Materials:
Insulation. Fibre.

Peter A. Frasse & Co.
New York, New York
Materials:
Steel (tubing, bar, sheet and stainless parts).

Frey-Yenkin Paint Co.
251 N. Sandusky St., Columbus, O.
A. Yenkin.
Materials:
Paint

W. P. Fuller & Company
301 Mission, San Francisco, Calif.
W. P. Fuller, Jr., pres.; D. L. Fuller, adv. mgr. & sales promotion mgr.
Materials:
Enamels. Dope. Lacquer.

Fulton Sylphon Company
Knoxville, Tennessee
W. Y. C. Hunt, pres.; R. N. Webster, vice-pres.; H. F. Hagedorn, treas.; F. G. Cross, gen. sales mgr.
Parts:
Valves.

G

Garlock Packing Company
Palmyra, New York
G. L. Abbott, pres. and treas.; Phil Arnold, vice-pres. charge of sales; C. R. Hubbard, vice-pres. charge of production; District managers: S. E. Anderson (Palmyra); A. E. Munch, Jr. (New York); H. J. Ramshaw (Chicago); L. P. Duggan (Philadelphia); F. E. Erlandson (St. Louis); F. L. Wallace (Boston); R. W. Perkins (Cleveland); Louis Mohm (Pittsburgh); E. A. Tolley (San Francisco); M. J. Lester (Denver); W. A. Redd, Jr. (Birmingham); C. W. Harmon (Los Angeles).
Parts:
Packings. Gaskets.

Garrison Engineering Co.
Great Barrington, Massachusetts
Parts·
Stampings.

Gem City Sheet Metal Co.
472 Huffman Ave., Dayton, Ohio
Parts:
Streamlinings.

General Cable Corporation
New York, New York
Factories:
Buffalo; Bayonne, N. J.; Emeryville, Calif.; Pawtucket; Perth Amboy; Rome, N. Y.; St. Louis; Los Angeles.
Branch office:
Healey Bldg., Atlanta; 89 Broad St., Boston; 56 Clyde Ave., Buffalo; 20 Wacker Drive, Chicago; 2637 Superior Ave., Cleveland; Interburban Bldg., Dallas; New Center Bldg., Detroit; 3600 E. Olympic Blvd., Los Angeles; 123 S. Broad St., Philadelphia; Koppers Bldg., Pittsburgh; Ambassador Bldg., St. Louis; 1000 Mill St., Rome, N. Y.; 30 Otis St., San Francisco; Smith Tower, Seattle; 730 15 St., N. W., Washington, D. C.
Parts:
Cable. Radio shielding. Ignition wiring.

General Drop Forge Co., Inc.
Buffalo, New York
W. B. Breyley, pres.
Parts:
Drop forgings (steel).

General Electric Corporation
(Plastics Department)
Lynn, Massachusetts
Materials:
Plastics (*Phenolic, Glytal, Textolite, Cetec*).

General Metals Company
Los Angeles, California
Parts:
Cylinder barrels. Forgings (steel).

General Plastics, Inc.
N. Tonawanda, New York
H. M. Dent, pres. & gen. mgr.; G. Becker, vice-pres.; J. F. Snyder, treas.; H. S. Spencer, adv. mgr. & sales promotion mgr.; F. A. Morlock, sales mgr.
Materials:
Plastics (phenolic, *Durez*).

General Tire & Rubber Co.
Akron, Ohio
W. O'Neil, pres.; R. W. Brown, ass't. sales mgr. in charge aviation sales; R. Iredell, chief eng.; A. G. Maranville, development and experimental eng.
Parts:
Rubber utilities (grommets; sheetings; packing).*

Gibson & Kirk
Baltimore, Maryland
Parts:
Castings. Forgings.

J. W. Gillette & Co.
812 Stephenson Bldg., Detroit, Mich.
Materials:
Upholstery.

The Glidden Company
Cleveland, Ohio
(Cleveland) D. P. Joyce, vice-pres.; G. B. Work, direct sales promotion mgr. (Reading) M. J. Pearce, industrial sales mgr. (Chicago) G. S. Hamilton, industrial sales mgr. (San Francisco) T. H. Zappert, regional director. (New Orleans) W. G. Smart, regional director. (Dallas) L. A. Day, regional director. (St. Louis) L. S. Fulton, regional director. (Boston) F. E. Coy, sales mgr. (Long Island) W. N. Cline, sales mgr. (Toronto) G. C. Mowat, regional director. (Minneapolis) W. C. Henke, regional director. (Birmingham) J. L. Beauchamp. (Miami) J. A. Gaddis. (Tampa) J. C. Brown. (W. Palm Beach) L. C. Drigers (Honolulu) B. R. McBride.
Factories:
(Paint, lacquer and varnish) Cleveland; Reading, Pa.; Toronto, Ont., Canada; 1853 N. LeClaire St., Chicago; 1300 Seventh St., San Francisco; (Paint and varnish) 424 Josephine St., New Orleans; 1901 E. Hennepin Ave., Minneapolis; Main & Gratiot Sts., St. Louis.
Branch offices:
44 Midway St., Boston; 2111-44 St., Long Island City, N. Y.; 1901 E. 61 St., Los Angeles; 1215 Elm St., Dallas; 2016 First Ave., Birmingham; 36 W. Flagler St., Miami; 412 Tampa Ave., Tampa.; 216 Olive St., West Palm Beach; 1245 S. Beretania St., Honolulu.
Materials:
Glidair paint. Lacquer. Dope. Enamel. Varnish. Primer. Fabric restorer (*Fabricote*).

Goetz Gasket & Packing Co.
New Brunswick, New Jersey
F. Goetz, pres. & gen. mgr.; A. R. Koltzbach, sec. & service mgr.; Kenneth McCreary, treas., sales, & adv. mgr.
Parts:
Gaskets.

Goodall Rubber Company
Philadelphia, Pennsylvania
R. F. Slaughter.
Factory:
Trenton, N. J.
Branch offices:
New York; Pittsburgh; Chicago; Trenton; Cleveland.
Parts:
Rubber utilities (molded pieces; flat washers).*

The B. F. Goodrich Company
Akron, Ohio
T. A. Aspell, gen. sales mgr.; J. S. Pedler, mgr. aeronautical sales dept.
Factories:
Akron; Los Angeles; Kitchener, Ontario, Canada.
Branch offices:
1043 Broadway, Albany; 376 Nelson St., S. W., Atlanta; 109 Brookline Ave., Boston; 1050 Main St., Buffalo; 4th & Brevard St., Charlotte, N. C.; 310 W. Taylor St., Chicago; Central Parkway at Sycamore St., Cincinnati; 4700 Prospect Ave., Cleveland; 4136 Commerce St., Dallas; 2625 Walnut St., Denver; 10430 Locust St., Des Moines; 2792 E. Grand Bldv., Detroit; 2009 Capitol Ave., Houston; 2422 Broadway, Kansas City, Mo.; 5400 E. Ninth, Los Angeles; 839 N. Jefferson, Milwaukee; 306 First Ave., N., Minneapolis; 133 Frelinghuysen Ave., Newark; 1742 St. Charles Ave., New Orleans; 619 W. 54th St., New York; 2034 Farnam St., Omaha; 1955 Hunting Park Ave., Philadelphia; 5740 Baum Blvd., Pittsburgh; 4481 Duncan Ave., St. Louis; 355 Brannan St., San Francisco; 1049 Railroad Ave., S., Seattle; 1522 14th St., N. W., Washington, D. C.
Parts:
Rubber utilities (spark plug nipples; grommets; radiator hose; refueling hose; ventilator hose; handle grips; *Air Speed* tubing; shock absorber discs; pontoon hand-hole covers; shock absorber cord).*†
Materials:
Rubber utilities (matting; window channel). Cement (airship seam; soundproofing; water seal). Rubber (sheet; sponge).*†

Goodyear Tire & Rubber Co.
Akron, Ohio
L. O. Guinther, mgr. aviation sales; H. M. White, ass't. mgr. aviation sales; L. D. Judd, director adv.; K. C. Zonsius, acting adv. mgr.
Parts and materials:
Rubber utilities.*

Govro-Nelson Company
Detroit, Michigan
V. Gauvreau.
Parts:
Cylinder heads. Cylinder barrels. Crankcases. Crankshafts. Valve seats. Connecting rods. Hardened and ground parts.

Graton & Knight
356 Franklin, Worcester, Mass.
F. H. Willard, pres. & gen. mgr.; F. E. Barth, vice-pres.; P. H. Wilson, sec.; C. A. Bartlett, treas.; C. O. Drayton, sales mgr.
Materials:
Leather.

Greist Manufacturing Co.
2119 Water St., New Haven, Conn.
Parts:
Link pins.

Grimm Foundry Company
Bound Brook, New Jersey
Parts:
Castings (aluminum).

Gwilliam Company
360 Furman St., Brooklyn, N. Y.
John Gwilliam, pres.
Parts:
Bearings.

H

Hamilton Foundry & Machine Co.
Hamilton, Ohio
P. E. Rentschler, pres.; D. McDaniel, vice-pres.
Parts:
Castings (*Meehanite* metal engine cylinders).

Hamilton Steel Co.
Cleveland, Ohio
Materials:
Tubing. Steel (bar; sheet; stainless).

Halcomb Steel Company
Geddes St., Syracuse, N. Y.
Materials:
Steel (bar; sheet).

Hartford Machine Screw Co.
476 Capitol Ave., Hartford, Conn.
H. E. Penfield, pres.; J. A. Taylor, vice-pres.; J. J. Kihm, purchasing agent.
Parts:
Valve tappets. Valve rocker shafts. Valve spring washers. Nuts and bolts.

(*Continued on following page*)

It's a Small World for the XP3Y-1

Master of great distances, XP3Y-1 introduces a new phase of national security with its ability to protect vast reaches of coast-line.

Sixty sister ships move down the production line at Consolidated Aircraft Corporation for delivery to our first arm of defense, the U. S. Navy.

Consolidated
AIRCRAFT CORPORATION
ESTABLISHED 1923
SAN DIEGO, CALIFORNIA

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Stewart Hartshorn Co.
250 Fifth Ave., New York, N. Y.
L. P. Bayard.
Plant:
Harrison, New Jersey.
Parts:
Tie rods. Steel (wire; stainless parts).

Haskelite Mfg. Corp.
208 W. Washington St., Chicago, Ill.
L. C. Nash, ass't. sales mgr.; O. H. Basquin, chief eng.; J. A. Potchen, civil eng. Representatives: (New York) C. E. Scott. (Detroit) E. W. Stoner. (Cleveland) E. R. Clarke.
Factory:
Grand Rapids, Mich.
Branch offices:
405 Lexington Ave., New York; 6432 Cass Ave., Detroit.
Materials:
Plywood (*Haskelite* sheet resin; blood glue; structural [soundproofing *Plywood* or *Plymetl*]). Flooring and cabin lining (plywood or aluminum *Plymetl*). *Steelwood* cabin lining.

Hazard Wire Rope Co.
New York, N. Y.
Jay O. Lashar.
Parts:
Steel wire. Steel cable.

George A. Hebb Company
102 Murray St., Newark, N. J.
Parts:
Springs.

Hill Aircraft Streamliners Co.
814 Reedy St., Cincinnati, Ohio
J. A. Hill, pres.; K. W. Abbott, sec.; W. A. Sundquist, factory supt.
Parts:
Streamlinings (NACA cowlings; speed rings; engine nacelles; wheel fairings; wing root fairings; spinners). Fuel and oil tanks.*

Hercules Powder Co., Inc.
Wilmington, Delaware
R. H. Dunham, pres.; C. A. Higgins, vice-pres.; C. A. Bigelow, gen. mgr.
Materials:
Plastics (cellulose).

Theodore Hergert, Inc.
422 E. 53rd St., New York, N. Y.
Parts:
Streamlinings.

Hilo Varnish Corporation
42-60 Stewart Ave., Brooklyn, N. Y.
C. J. Schumann, pres. & sales mgr.; J. Mattiello, technical director.
Branch offices:
Chicago; Boston; Philadelphia.
Materials:
Paint (semi-gloss black baking japan and finishing black baking japan for engine cylinders; *Crystal* finishes for instruments, cameras, etc.). Enamel for camera interiors (*Dull Black*). Varnish. Lacquer.

Hirst-Roger Carpet Co.
North Wales, Pennsylvania
Materials:
Carpets.

Hope Webbing Co.
1005 Main St., Pawtucket, R. I.
Materials:
Webbing.

E. F. Houghton & Company
Philadelphia, Pennsylvania
Materials:
Leather.

C. W. House & Sons
505 Fifth Ave., New York, N. Y.
Factory:
Unionville, Conn.
Materials:
Felt. Webbing.

Husband Aircraft Specialties
6545 Carnegie Ave., Cleveland, O.
Parts:
Fittings (fuel and oil line).

Hyatt Roller Bearing Co.
Newark, New Jersey
H. J. Forsythe, pres. and gen. mgr.; H. O. K. Meister, asst. gen. mgr.; H. K. Porter, gen. mgr. of sales.
Parts:
Hyatt roller bearings.

I

Ideal Clamp Mfg. Co., Inc.
200 Bradford St., Brooklyn, N. Y.
L. Rauch.
Parts:
Hose clamps.

Imperial Brass Mfg. Co.
524 S. Racine Ave., Chicago, Ill.
C. H. Benson.
Parts:
Valves. Fuel system fittings.

Indiana Gear Works
1458 E. 19th St., Indianapolis, Ind.
L. C. Buehler, pres.; John Buehler, engineer.
Parts:
Camshafts. Piston pins. Valve guides. Gears.

Indiana Veneer & Panel Company
New Albany, Ind.
C. M. Hilton, sales director.
Branch offices:
Crescent Panel Co., Inc., 3229 W. Market St., Louisville.
Materials:
Plywood

Industrial Engineering & Mfg. Co.
239 John St., Bridgeport, Conn.
Parts:
Fastening devices.

Industrial Steel Casting Co.
Toledo, Ohio
Parts:
Castings (steel).

Insulite Company
Minneapolis, Minnesota
R. H. M. Robinson, pres.; C. S. Pope, executive vice-pres.; E. H. Batchelder, Jr., vice-pres. charge of sales; M. G. Jensen, sales mgr.
Materials:
Insulation (*Insulate*).

International Piston Ring Co.
Cleveland, Ohio
H. F. Gray.
Parts:
Piston rings.

J

Jadson Motor Products Co.
8353 Wilcox Ave., Bell, Calif.
P. J. Sampson, pres. & gen. mgr.; A. L. Robb, vice-pres. in charge aeronautical sales; L. P. Drake, vice-pres. in charge production.
Parts:
Valves. Valve seat inserts. Valve stem guides. Piston pins.

Jessop Steel Company
Washington, Pennsylvania
Materials:
Stainless steel (bar).

Johns-Manville, Inc.
New York, N. Y.
L. H. Brown, pres.; L. R. Hoff, vice-pres. & gen. sales mgr.; J. H. Trent, vice-pres. in charge transportation dept.; H. M. Shackelford, adv. mgr. & sales promotion mgr.
Materials:
Asbestos. Insulation material. Soundproofing material.

Johnson Bronze Company
Newcastle, Pennsylvania
P. J. Flaherty, pres.; J. P. Flaherty, sec. & treas.; Eugene Scanlon, adv. & sales promotion mgr.; L. Sandler, ass't. gen. mgr.
Parts:
Bushings (bronze).

S. C. Johnson, Inc.
Racine, Wisconsin
H. F. Johnson, Jr., pres.; C. A. Armstrong, vice-pres.; P. M. Petersen, gen. sales mgr.
Materials:
Wax.

Jones-Dabney Company., Inc.
Louisville, Ky.
E. D. Horgan, divisional sales mgr. (Louisville).
Factories:
Louisville; Detroit.
Branch offices:
Chicago; Detroit; Evansville; Fort Smith, Ark.; Grand Rapids.
Materials:
Dope. Lacquer. Varnish. Enamel.

W. B. Jones Spring Company
809 Walnut St., Cincinnati, Ohio
Parts:
Springs.

Jones Motrola Company
Whitlock Ave., New York, N. Y.
Parts:
Motor operated fuel pumps.

K

The Kay & Ess Company
Kiser & Leo Sts., Dayton, Ohio
A. J. Turner, vice-pres. in charge aeronautical sales.
Materials:
Enamel. Aluminum liquid. Dope (*Superloid*). Lacquer.

Keasbey & Mattison Co.
Butler Ave., Ambler, Penn.
A. S. Blagden, pres.; W. J. Donahue, vice-pres.; W. C. Scott, sec. and treas.; W. S. Acuff, sales promotion mgr.
Materials:
Asbestos.

Kellogg Switchboard & Supply Co.
1066 W. Adams St., Chicago, Ill.
G. A. Yanochowski, pres.; J. G. Kellogg, vice-pres. and sec.; H. C. McCluskey, treas.; H. E. Billington, gen. sales mgr.
Parts:
Fasteners. Electrical equipment.

Kirkham Engineering & Mfg. Corp.
Farmingdale, L. I., N. Y.
Parts:
Streamlinings.

Kline Spring Company
Cleveland, Ohio
Parts:
Springs.

Otto Konigslow Mfg. Co.
3610 Perkins Ave., Cleveland, Ohio
O. Konigslow, Jr., pres.; D. C. Lowles, vice-pres.; M. E. Konigslow, sec-treas.
Parts:
Stampings (sheet metal manufactured to specifications).

Krodel Foundry
Waterbury, Connecticut
Parts:
Castings (bronze and aluminum).

L

Ladish Drop Forge Co.
Cudahy, Wisconsin
R. M. Foltz, vice-pres. in charge sales.
Parts:
Forgings (engine crankshafts; connecting rods; camshafts; rocker arms; gears; propeller blades; fixed- and controllable-pitch propeller hubs; control fittings; landing gear parts; solid and hollow tail wheel knuckles).

The Laidlaw Company, Inc.
16 W. 60th St., New York, N. Y.
W. R. Laidlaw, pres. & treas.; E. F. Griffin, aeronautical sales; G. A. Havemeyer, sales promotion and research.
Factories and mills:
Monson, Mass.; Pawtucket; Philadelphia.
Materials:
Upholstery (cabin interior). Textile trimmings. Carpets. Curtain silks. Silk cord hat and luggage racks. Seat cover cloths.

Lamson & Sessions Co.
Cleveland, Ohio
Parts:
Hardware (cotter pins).

Latrobe Electric Steel Co.
Latrobe, Pennsylvania
Materials:
Steel (stainless sheet).

Lebanon Steel Foundry
Lebanon, Pennsylvania
W. H. Worrilow, pres.; T. S. Quinn, treas.; K. V. Wheeler, gen. mgr.; T. V. Blodgett, sales mgr.; P. E. Gerhard, sales eng.
Branch offices:
3701 N. Broad St., Philadelphia.
Parts:
Castings (manufactured to specifications from *Circle* "L" No. 2 manganese-chrome-molybdenum steel; No. 3 manganese-chrome-molybdenum steel; and No. 23 stainless steel).

Lee Spring Co., Inc.
30 Main St., Brooklyn, N. Y.
W. D. Gent.
Parts:
Springs.

W. Leechburg Steel Co.
Leechburg, Pa.
Materials:
Steel (sheet).

Leland Gifford Company
Southbridge St., Worcester, Mass.
S. B. Dowd; A. J. Gifford.
Parts:
Crankshafts.

Lewis Street Glass Co.
216 W. Lewis St., Wichita, Kansas
Materials:
Cabin glass.

Libbey-Owens-Ford Glass Co.
Nichols Bldg., Toledo, Ohio
G. P. MacNichol, Jr., vice-pres. in charge sales; G. B. Watkins, chief eng. in charge research.
Factories:
Toledo; Rossford, O.; Charleston, and Parkersburg, W. Va.; Shreveport; Ottawa, Ill.
Branch offices:
General Electric Bldg., New York; Syracuse Hotel, Syracuse (under New York supervision); Integrity Bldg., Philadelphia; Statler Bldg., Boston; 250 Delaware Ave., Buffalo; Fisher Bldg., Detroit; State Planters Bank Bldg., Richmond; Bona Allen Bldg., Atlanta; American Bldg., Cincinnati; Conway Bldg., Chicago; 910 E. Wisconsin Ave., Milwaukee; (under Chicago supervision); Wesley Temple Bldg., Minneapolis; R. A. Long Bldg., Kansas City, Mo.; P. O. Box 1401, Denver; (under Kansas City supervision); Rialto Bldg., San Francisco; P. O. Box 3142, Seattle; (under San Francisco supervision); Architects Bldg., Los Angeles; Shreveport; P. O. Box 2274, Dallas; (under Shreveport supervision).
Materials:
Safety glass.

Lincoln Machine & Tool Co.
1068 Main St., Pawtucket, R. I.
Parts:
Connecting rods.

Lord Manufacturing Co.
Erie, Pennsylvania
T. Lord, pres.; T. L. Yates.
Factory:
1316 Holland St., Erie, Pa.
Parts:
Rubber tube form mountings (engine mountings). Rubber utilities (plate form shear type mountings for instruments, instrument panels, radio; battery box containers; chair leg cushions).
Materials:
Bonded rubber channel strip (cabin glass or landing light window supports).

Los Angeles Spring & Forge Co.
Los Angeles, California
Parts:
Springs.

The Lowe Brothers Co.
452 E. 3d St., Dayton, Ohio
D. A. Kohr, pres. & gen. mgr.; W. O.

(Continued on following page)

See this outstanding airplane—*226 miles per hour—twin engines—single engine ceiling with full load 10,000 feet—cruising range 880 miles—eight place—sound proofed—all metal.*

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If you are interested in the possible purchase of a Lockheed 12 get in touch immediately with the nearest company office and a demonstration will be arranged while this airplane is in your vicinity.

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BURBANK CALIFORNIA

New York Office: 614 Chrysler Bldg. • Chicago Office: 2353 Field Bldg. • Dallas Office: Hangar No. 4, Love Field

THE NEW
12

LOCKHEED

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Zehring, sales mgr.; L. L. Anderson, ass't. sales mgr.; R. E. Mercer, adv. mgr.
Materials:
Enamel. Varnish. Paint.

Ludlum Steel Company
Watervliet, New York
H. G. Batcheller, pres.; A. F. Dohn, vice pres. charge of sales; F. B. Lounsberry, vice-pres. in charge of production; N. F. Towner, sec.; I. J. Morris, treas.
Branch offices:
Atlanta; Birmingham; Chicago; Cincinnati; Cleveland; Detroit; Houston; Newark; Philadelphia; Pittsburgh; Rochester; Buffalo; Syracuse; Rutland; San Francisco; Los Angeles; St. Louis; Springeld, Mass.
Plant:
Dunkirk, New York.
Materials:
Steel (*Silcrome*).

Lumen Bearing Company
215 Lathrop St., Buffalo, N. Y.
N. F. Young, pres., gen. mgr. & sales mgr.; C. H. Bierbaum, chief eng.
Parts:
Valve seats. Valve guides. Castings bronze [aluminum; manganese]; red brass). Gears (cast bronze).

The Lunkenheimer Company
Cincinnati, Ohio
Branch offices:
New York, Chicago, Boston, Philadelphia, San Francisco.
Parts:
Valves. Fittings (fuel line). Tubing (fuel line).

M

Macwhyte Company
Kenosha, Wisconsin
J. S. Whyte, vice-pres. & gen. mgr.; R. G. Diehl, aeronautical sales and engineering.
Parts:
Tie rods (streamline; round drawn; square drawn). Cable (flexible; non-flexible). Steel hardware (safe lock terminals; clevis pins; rigid terminals; hexagon lock nuts). Wire rope.

Magosy & Buscher
224 Canal St., New York, N. Y.
C. W. Buscher.
Parts:
Streamlinings. Collector rings. Cowls.

Marlin-Rockwell Corp.
Jamestown, New York
A. C. Davis, vice-pres. & gen. mgr.; H. A. Johnson, sales mgr.; B. J. Shallow, N. Y. district sales representative.
Factories:
Jamestown, N. Y.; Plainville, Conn.
Branch offices:
40 W. 63 St., New York; 5046 Cass Ave., Detroit; 2526 S. Michigan Ave., Chicago.
Parts:
Ball bearings (sealed; narrow width, super-precision).

Marquette Metal Products Co.
Galewood Drive, Cleveland, Ohio
J. S. Kustin.
Parts:
Piston pins. Link pins. Nuts and bolts.

Meisel Press Mfg. Co.
950 Dorchester Ave., Boston, Mass.
S. A. Smith.
Parts:
Gears. Sprockets.

McCord Radiator & Mfg. Co.
Detroit, Michigan
E. O. Bodkin.
Parts:
Gaskets.

McGill Manufacturing Co.
Valparaiso, Indiana
C. S. McGill, vice-pres.; W. E. Brownell, gen. mgr.; T. L. Robinson, aeronautical eng.
Parts:
Ball bearings (*Multirol* full-type roller).

McPherson's Aluminum & Brass Foundry
1218 Elati St., Denver, Colo.
Parts:
Castings (aluminum).

McQuay-Norris Mfg. Co.
St. Louis, Missouri
A. J. Mummert; J. V. Cassani.
Parts:
Piston pins.

W. Megin Lumber Co.
Naugatuck, Connecticut
Materials:
Wood (pine; maple; white wood).

Merrimac Chemical Co.
Boston, Massachusetts
Dr. L. A. Pratt, director of sales; Dr. H. L. Whalen, research; A. W. Dunning, salesman for aeronautical products.
Materials:
Acetate fire resistant finishes. Dope. Thinner. Lacquer. Surfacer. Primer. Synthetics.

Metal & Alloy Specialties Co., Inc.
1875 Elmwood Ave., Buffalo, N. Y.
T. S. Hemenway.
Parts:
Castings.

Metal Goods Corporation
2408 N. 10th St., St. Louis, Mo.
Warehouses:
1701 Baltimore Ave., Kansas City, Mo.; 1121 Rothwell St., Houston, Tex.
Materials:
Aluminum (rivets and tubing).

Met-L-Wood Corporation
Chicago, Illinois
Materials:
Wood. Plywood.

Mica Insulator Company
200 Varick St., New York, N. Y.
Parts:
Tubing (cambric varnished).

Michigan Seamless Tube Co.
South Lyon, Michigan
W. McMunn, pres.; J. S. O'Rourke, vice-pres.
Parts:
Tubing (steel).

Michigan Smelting & Refining Co.
Detroit, Michigan
Materials:
Bronze ingot.

Milford Rivet & Machine Co.
Milford, Connecticut
Parts:
Rivets (tubular).

Miller & Van Winkle
18 Bridge St., Brooklyn, N. Y.
E. Miller.
Parts:
Springs.

Misawaka Rubber & Woolen Mfg. Co.
Mishawaka, Indiana
E. J. W. Fink, pres. and gen. mgr.; G. W. Blair, vice-pres.; V. F. Ludwig, sales mgr.
Materials:
Rubber.
Parts:
Seats (rubber).

Mohawk Carpet Mills
295 Fifth Ave., New York, N. Y.
A. W. Shuttleworth, pres. & gen. mgr.; H. L. Shuttleworth, vice-pres. & treas. (Amsterdam); V. Bowman, gen. sales mgr.; T. E. Brown, asst. gen. sales mgr.; E. G. Tuttle, adv. mgr. (New York City).
Factory:
Amsterdam, N. Y.
Materials:
Carpets.

Molded Insulation Co.
3246 Ludlow St., Philadelphia, Pa.
V. I. Zelov, pres.; M. K. Goldstein, research eng.
Parts:
Pulleys (control). Radio accessories. Bakelite molded parts and assemblies.

Motor Casting Co.
Milwaukee, Wisconsin
Parts:
Castings (iron).

Mueller Brass Company
Port Huron, Michigan
Materials:
Extruded aluminum. Bronze rod.

L. Mundet & Sons
100 S. 11th St., Brooklyn, N. Y.
Materials:
Cork.

Murphy Varnish Company
Newark, New Jersey
C. J. Roh, pres.; P. S. Kennedy, vice-pres.; H. W. Lay, gen. sales mgr.
Branch offices:
Chicago; San Francisco.
Materials:
Varnish. Enamel. Lacquer. Dope.

Muskegon Specialties Co.
Muskegon, Michigan
Factories:
Muskegon and Jackson, Mich.
Parts:
Camshafts. Crankshafts.

Muskegon Ring Company
Muskegon, Michigan
Parts:
Piston rings.

N

National Aircraft Materials Corp.
Rutland, Vermont
Materials:
Wood. Plywood.

National Copper Paint Co.
436 N. Well St., Chicago, Ill.
Materials:
Paint.

National Copper & Smelting Co.
12120 Euclid Ave., Cleveland, O.
Parts:
Tubing (copper).

National Lockwasher Co.
40 Hermon St., Newark, N. J.
Parts:
Lock washers.

National Tube Co.
(Div. U. S. Steel Corp.)
Pittsburgh, Pennsylvania
Parts:
Tubing (steel). Exhaust stacks.

New Jersey Veneer Co.
Paterson, New Jersey
F. T. Perrine.
Materials:
Wood (plywood).

National Vulcanized Fibre Co.
Wilmington, Delaware
J. W. Marshall, pres.; J. K. Johnston, vice-pres.; H. C. Hackett, sales mgr. (Wilmington); D. W. Stewart (Watertown); W. B. Cosgrave (New York); T. B. Baldridge (Philadelphia); I. V. Brooks (Baltimore); R. S. Fisher (Cleveland); E. W. Wessel (Pittsburgh); W. H. Beaven (Birmingham); R. O. Wire (Detroit); G. W. Glaescher (Chicago); G. C. Reynolds (St. Louis); C. N. Wade (Rochester); C. E. Drury (Dayton); R. F. Bauer (Cincinnati); J. R. Cameron (Bluefield); I. H. Alcorn (New Haven); F. J. Klenck (San Francisco); Geo. Hamburger (Denver); H. A. Frankel (Toronto); R. G. Henderson (Charlotte, N. C.); R. L. Miller (Milwaukee).
Branch offices:
36 Pleasant St., Watertown, Mass.; 30 Church St., New York; Girard Trust Bldg., Philadelphia; 15 E. Saratoga St., Baltimore; National Bldg., Cleveland; Oliver Bldg., Pittsburgh; 2219 5th Ave., S., Birmingham; Kresge Bldg., Detroit; 2808 W. Lake St., Chicago; 4903 Delmar Blvd., St. Louis; Powers Bldg., Rochester, N. Y.; Dayton Industries Bldg., Dayton; 626 Broadway, Cincinnati; P. O. Box 33, Bluefield, W. Va.; Plymouth Bldg., New Haven; 107 Atlantic Ave., Toronto, Canada; Builders Bldg., Charlotte, N. C.; 1715 California St., Denver; National Insulations Co., 342 N. Water St., Milwaukee; F. J. Klenck Co., 311 Minna St., San Francisco; 451 E. 3rd St., Los Angeles; 305 NW 12 St., Portland, Ore.; 615 Fourth Ave., Seattle; Hutton Bldg., Spokane.
Parts:
Fibre gears and pinions.
Materials:
Fibre (sheet; tube; rod). *Phenolite* (laminated sheet; tube; rod).

New Departure Mfg. Co.
Bristol, Connecticut
F. G. Hughes, gen. mgr.; L. G. Sigourney, gen. sales mgr.; T. C. D. Crow, chief eng.
Engineering branches:
Detroit; San Francisco; New York; Chicago.
Parts:
Ball bearings (steel).

New Jersey Zinc Sales Co., Inc.
160 Front St., New York, N. Y.
J. E. Hayes, pres.; F. N. Spencer, vice-pres.; R. G. Hudson, sec.; M. L. Havey, gen. sales mgr.
Materials:
Zinc (alloys; pigments).

Niagara Asbestos Co.
Buffalo, New York
Materials:
Asbestos.

Nicholas-Beazley Airplane Co., Inc.
Marshall, Missouri
Howard Beazley, pres.; Charles M. Buckner, Jr., vice-pres. and purchasing agent; Charles A. Bell, vice-pres. in charge of sales; Cary Huston, treas.
Branch offices:
Glendale, Calif.; Love Field, Dallas, Tex.; Brooklyn, N. Y.
Parts:
Fittings. Cowling fasteners. Cowlings, studs and pins. Speed rings. *†
Materials:
Sponge rubber sheet.

Nicralumin Company
145 W. Cortlandt St., Jackson, Mich.
J. E. Tingay.
Materials:
Nicral alloy.

Nixon Nitration Works
Nixon, New Jersey
T. D. L. Mabry, director of sales.
Materials:
Transparent sheet.

Norma Hoffmann Bearings Corp.
Stamford, Connecticut
W. M. Nones, pres. & treas.; O. P. Wilson, vice-pres.; H. J. Ritter, sales mgr.; C. B. Malone, factory mgr.; G. R. Bott, engineering mgr.; F. L. Wright, research eng.; D. E. Batesole, asst. eng. mgr.
Branch offices:
155 E. 44 St., New York; 310 S. Michigan Ave., Chicago; Hanna Bldg., Cleveland; 632 E. Lake Dr. Decatur, Atlanta; 105 Fahnestock Rd., Pittsburgh; American Bldg., Cincinnati; Eaton Tower, Detroit.
Parts:
Ball bearings (double metal seal and extra light single row; single row with and without metal seal; *GreaSeal* felt-protected single row; double row self-aligning; open type single row). Precision ball bearings (extra light closed type; angular contact; separable; one-lipped separable; two-lipped non-separable; full roller retainerless; extra light separable). Thrust bearings (single direction; extra light single direction; double direction). Stainless steel bearings. Cadmium plated bearings. Pin bearings. Needle bearings.

North Bergen Paint & Varnish Co.
North Bergen, New Jersey
J. L. Bauer, pres. & gen. mgr.; W. J. Harris, vice-pres. & sec.
Materials:
Paint. Varnish. Lacquer. Enamel.

(Continued on following page)

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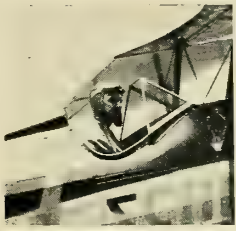
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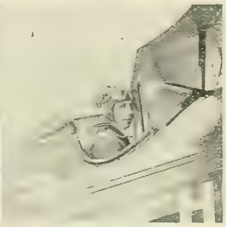
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Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

O

Ohio Crankshaft Co.
6600 Clement Ave., Cleveland, O.
W. C. Dunn, pres.
Parts:
Crankshafts.

The Ohio Piston Co.
Cleveland, Ohio
C. Birnbaum, pres.; E. J. Gutman, vice-pres.; D. P. Shaw, mgr.
Parts:
Pistons. Piston pins. Cylinder sleeves.

Ohio Rubber Co.
Willoughby, Ohio
Parts:
Rubber parts.

Oklahoma Steel Castings Co.
Tulsa, Oklahoma
Parts:
Castings (steel).

The Ohio Seamless Tube Co.
Shelby, Ohio
A. Waines, supervisor of sales.
Branch offices:
2857 E. Grand Blvd., Detroit; Citizens Bldg., Cleveland; 1225 W. Washington Blvd., Chicago. Eastern representative: Joseph T. Ryerson & Son, Inc., Jersey City; Philadelphia; Boston.
Parts:
Tubing (cold drawn seamless steel).

P

Pacific Lumber Agency
Aberdeen, Washington
T. W. Tebb.
Materials:
Wood.

Pacific Metals Company
3100 19th St., San Francisco, Calif.
Walter Schroeder.
Parts:
Aluminum, Monel and copper parts.

Packard Electric Corp.
Warren, Ohio
B. N. MacGregor, vice-pres. & gen. mgr.; G. S. Carr, sales mgr. of eqpt. division; R. J. Montgomery, mgr., replacement division; L. C. Wolcott, chief eng.
Parts:
Electric cable (shielded and unshielded high tension; lighting; two-conductor; combination single- and two-conductor; landing light; starter and power). Braided sleeving.

The Palnut Company
Irvington, New Jersey
J. R. Hotchkin, pres.; A. H. Beggs, vice-pres. & sales mgr.
Parts:
Locknut (*Palnut* spring steel, cadmium finish).

Pantosote Company, Inc.
250 Park Avenue, New York, N. Y.
E. H. Outerbridge, pres.
Materials:
Upholstery fabric (imitation leather).

Paramount Welded Aluminum Products Corp.
341 39th St., Brooklyn, N. Y.
Phil J. Billig, engineer.
Parts:
Fuel tanks.

The Park Drop Forge Co.
Cleveland, Ohio
G. C. Gordon, pres.
Parts:
Forgings (crankshaft; connecting rod; camshaft; gear; propeller hub; master rod). Finished products (crankshafts; camshafts).

Parker Appliance Company
10320 Berea Rd., Cleveland, O.
A. L. Parker.
Parts:
Valves.*

Parker-Kalon Corp.
New York, New York
S. S. Kahn.
Parts:
Nuts and bolts. Screws (hardened self-tapping sheet metal; metallic drive; thumb; socket head cap).

Peco Manufacturing Co.
Philadelphia, Pennsylvania
W. F. Errig.
Parts:
Weldings.

Penn Rivet Company
Philadelphia, Pennsylvania
J. Clement.
Parts:
Rivets.

Perfect Circle Company
Hagerstown, Indiana
H. Teetor.
Parts:
Piston rings.

The Permatex Co., Inc.
Sheepshead Bay, L. I., N. Y.
C. A. Benoit.
Materials:
Finishes.

Perry-Austin Mfg. Co.
Grasmere, Staten Island, N. Y.
F. T. Perry.
Materials:
Dope (pigmented and clear). Thinner. Lacquer. Paint.

Phenix Aircraft Products Co.
5565 Main St., Williamsville, N. Y.
N. S. Hopkins, pres.
Materials:
Dope (clear; pigmented). Lacquer.

Phillips Bronze Bushing Works
Los Angeles, California
Parts:
Castings (bronze).

Philpott Rubber Company
1381 W. Third St., Cleveland, O.
Parts:
Rubber parts.

Phoenix Specialty Mfg. Co.
155 Wooster St., New York, N. Y.
Parts:
Springs.

Phosphor Bronze Smelting Co.
Philadelphia, Pennsylvania
Materials:
Phosphor bronze (sheet).

The Pike-Dial Lumber Co.
2251 S. Loomis St., Chicago, Illinois
W. T. Osgood.
Materials:
Sitka spruce (rough; cut to dimensions).

Pittsburgh Plate Glass Co.
Grand Bldg., Pittsburgh, Pa.
L. F. Theurer, in charge aeronautical sales; P. R. Croll, director of research (Milwaukee); F. L. Theurer, production mgr.
Factories:
(Paint and Varnish Division) Milwaukee; Newark; Portland, Ore.; Los Angeles. (Ditzler Color Division) Detroit.
Branch offices:
235 E. Pittsburgh Ave., Milwaukee; Newark; Portland, Ore.; Los Angeles; Detroit.
Materials:
Paint (heat resistant aluminum liquid; standard Army color oil base enamel; black engine enamel; acid proof black enamel). Dope (*Mimax* thinner; sealer). Varnish (clear aircraft). Lacquer (*Mimax*). Windshield and enclosure material. Cabin glass.

Pollack Manufacturing Co.
Arlington, New Jersey
Parts:
Collector rings.

Port Orford Cedar Products Co.
Marshfield, Oregon
Materials:
Wood.

Porter Top Co.
1013 E. 15th St., Kansas City, Mo.
Materials:
Upholstery.

J. V. G. Posey Co., Portland, Ore.
J. V. G. Posey.
Materials:
Spruce.

Positive Lockwasher Co.
Newark, New Jersey
Parts:
Lock washers.

Pratt & Lambert, Inc.
73 Tonawanda St., Buffalo, N. Y.
T. E. Murphy, mgr. industrial sales.
Branch offices:
Chicago; New York; Fort Erie, Ontario, Canada.
Materials:
Paint (enamel; primer). Dope. Varnish. Lacquer.

Horace T. Potts
Erie & D Sts., Philadelphia, Pa.
T. C. Potts.
Parts:
Steel forgings and bushings.

Premier Bronze Corp.
1022 N. Sixth St., St. Louis, Mo.
H. Rubelmann, pres.
Materials:
Bearing bronze (bushing, cored and solid bars; casting; babbit; rebabbitting). Cast iron and aluminum solder. Gear bronze.

Progressive Brass Co.
Tulsa, Oklahoma
Parts:
Forgings (steel). Bushings.

Progressive Manufacturing Co.
Torrington, Connecticut
Parts:
Rivets (steel).

Protecto Safety Glass Corp.
Glendale, Long Island, New York
M. Friedman, pres.
Materials:
Safety glass.

Pump Engineering Service Corp.
12910 Taft Avenue, Cleveland, O.
Wm. S. Jack, Pres.; J. P. Johnson, vice-pres. and gen. mgr.; Wm. R. Jack, treas. Representatives: George A. Gray, Munsev Bldg., Washington, D. C.; Fred Marshall, 108 Maplewood, Dayton; George W. Jack, El Cajon, Calif.; J. Corin, 2037 Oakman Blvd., Detroit.
Parts:
Pumps (fuel; vacuum; air; oil). Fuel control. Gear box.

Pyratone Products Corp.
Chicago, Illinois
Materials:
Impregnated wood.

Q

The Quadriga Manufacturing Co.
217 W. Grand Ave., Chicago, Ill.
Parts:
Stampings. Washers (steel). Shims (steel).

R

Radel Leather Co.
Newark, New Jersey
F. J. Radel, pres.; R. H. Cudlipp, sales mgr.
Materials:
Upholstery (leather).

Railway Steel Spring Co.
30 Church St., New York, N. Y.
Parts:
Springs.

Ramsey Accessories Mfg. Corp.
St. Louis, Missouri
C. A. Marien, vice-pres. in charge research; H. B. Stout, vice-pres. in charge sales; W. G. Myers, vice-pres. in charge of adv.
Parts:
Piston rings.

Randolph Finishing Products Co.
Hasbrouck Heights, N. J.
W. G. Randolph.
Materials:
Lacquer. Synthetic products. Special finishes. Dope (nitrate; acetate).

The Manhattan Rubber Mfg. Div. (of Raybestos-Manhattan, Inc.)
61 Willett St., Passaic, New Jersey
C. T. Young, factory mgr. & purchasing agent.
Factories:
Passaic; Nennah, Wis.; Whippany, N. J.
Branch offices:
1108 N. Fifth Ave., Birmingham; 10 High St., Boston; 445 Lake Shore Drive, Chicago; Fisher Bldg., Detroit; 404 Washington Ave. N., Minneapolis; 1007 Camp St., New Orleans; 120 Broadway, New York; Broad Street Station Bldg., Philadelphia; Koppers Bldg., Pittsburgh; 1606 Pine St., St. Louis.
Parts:
Rubber utilities (engine mountings; control stick grips; fuel tank insulation; moulded rubber). Gaskets (oil proof).†

Reliable Pattern Co.
Cincinnati, Ohio
Parts:
Castings.

Republic Steel Corp.
Massillon, Ohio
T. M. Girdler, pres. & chairman of the board; R. J. Wysor, exec. vice-pres. & gen. mgr.; M. A. Wick, vice-pres.; N. J. Clarke, vice-pres. in charge sales; C. M. White, vice-pres. in charge operations; J. Kahn, vice-pres. in charge product development; D. B. Gillies, vice-pres.
Factories:
Pittsburgh; Birmingham; Buffalo; Canton, Cleveland, Elyria, Massillon, Niles, Warren and Youngstown, Ohio; Chicago, South Chicago and Moline, Ill.; Muncie, Ind.; Unionville, Conn.
Branch offices:
Empire Bldg., Birmingham; Liberty Bank Bldg., Buffalo; Carew Tower, Cincinnati; Continental Oil Bldg., Denver; Grand Rapids Trust Bldg., Grand Rapids; Circle Tower Bldg., Indianapolis; Chrysler Bldg., New York; Broad St. Station Bldg., Philadelphia; Atlas Bldg., Salt Lake City; White-Henry-Stuart Bldg., Seattle; Thompson Bldg., Tulsa; 250 Stuart St., Boston; McCormick Bldg., Chicago; Republic Bldg., Cleveland; Fisher Bldg., Detroit; Gulf Bldg., Houston; California Edison Bldg., Los Angeles; First Wisconsin National Bank Bldg., Milwaukee; Oliver Bldg., Pittsburgh; Paul Brown Bldg., St. Louis; Ohio Bank Bldg., Toledo; Republic Bldg., Youngstown, O.; 78 State St., Albany; Dwight Bldg., Kansas City, Mo.; Rialto Bldg., San Francisco; Shoreham Bldg., Washington, D. C. General Export Department: Chrysler Bldg., New York.
Materials:
Steel (alloy; standard SAE and specials; nitralloy; *Euduro* stainless). Chrome and chrome nickel (sheet); strip; plate; bar; tubular; slab; billet). Nuts, bolts and rivets. Wire.

Resinox Corporation
New York, New York
Materials:
Plastics (phenolic, *Resinox*).

Revere Copper and Brass, Inc.
230 Park Avenue, New York, N. Y.
C. Donald Dallas, pres.; J. A. Doucett, J. L. Dryden, Rollo E. Falk, C. C. Felton, C. W. Katenkamp, J. M. Kennedy, C. A. Macfie, R. G. Scott, C. W. Thomas, H. S. Ullmann, R. A. Wilkins, H. D. Wolfe, vice presidents; J. J. Russell, sec. and treas.; R. H. Binns, S. H. Wilson, asst. gen. sales managers; W. Weir Henry, asst. sales mgr.
Parts:
Bronze, brass and copper parts.

Rhode Island Tool Co.
Providence, Rhode Island
Parts:
Nuts and bolts.

Rich Manufacturing Co.
Battle Creek, Michigan
Howard H. Rich.
Parts:
Valves.

(Continued on following page)

WACO

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● The complete facilities of the largest service organization maintained by any aircraft manufacturer are available to owners of Waco airplanes. More than 100 authorized agents for the sales and servicing of Wacos are located in 35 states and Alaska, and 16 foreign countries.

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TROY, OHIO, U. S. A.

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Reading, Pa.

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Garden City—Chicago—Glendale

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Rinshed Mason Co.
Detroit, Michigan
Materials:
Lacquer.

C. A. Roberts Company
Detroit, Michigan
Parts:
Tubing (copper).

Roberts Tube Works
2500 Military Ave., Detroit, Mich.
Parts:
Fuel line tubing.

Roddis Lumber & Veneer Company
402 Elm St., Dallas, Texas
Materials:
Plywood.

John A. Roebling's Sons Co.
Trenton, New Jersey
R. P. Tyler.
Factories:
Trenton and Roebling, N. J.
Branch offices:
107 Liberty St., New York; 51 Sleeper St., Boston; 205 W. Wacker Drive, Chicago; 223 Arch St., Philadelphia; 701 St. Claire Ave., N. E., Cleveland; 934 Avon Ave., Atlanta; John A. Roebling's Sons Co. of California: 624 Folsom St., San Francisco; 216 S. Alameda St., Los Angeles; 1032 N. W. 14 Ave., Portland, Ore.; 900 First Ave., S., Seattle.
Parts:
Wire and wire rope (standard tinned; galvanized strand; galvanized cotton or wire center cord). Insulated wire. Insulated cable (high tension ignition; shielded and unshielded for power and lighting circuits; single and two-conductor braided or shielded; single and two-conductor shielded tinned copper braid power and lighting circuit). Galvanized steel thimbles. Steel ferrules. Wire rope fittings and slings. Electric or gas welding wire. Serving and locking wire. Balloon cable. Wire (brass; copper; steel). Control casing (cord; strand).

Rohm & Haas Company
Philadelphia, Pennsylvania
Materials:
Transparent sheet (*Plexiglass*).

Romec Pump Company
333 E. Bridge St., Elyria, O.
E. W. Beidler, pres.; Hayden Eames, vice-pres.; B. A. Schulze, sec.-treas.; W. L. Davis, gen. mgr.
Branch offices:
Pacific Scientific Co., 1206 Maple Ave., Los Angeles; 37 Spear St., San Francisco; Aviation Equipment & Export, Inc., 25 Beaver St., New York.
Parts:
Pumps (fuel; vacuum; deicer; hand; hydraulic). Air compressors. Auxiliary gear boxes.

Rubatex Products, Inc.
277 Park Ave., New York, N. Y.
Dudley Roberts, pres.; Fred W. Peel, vice-pres. & gen. mgr.; S. E. Kienitz.
Factory:
Bedford, Va.
Materials:
Rubber utilities (*Rubatex* soundproofing; insulation; gaskets).

Rubbercraft Corp. of California, Ltd.
E. 17th St., Los Angeles, Calif.
C. N. Merralls, pres.; R. H. Newell, production mgr.; F. N. Merralls, mgr. general research.
Factory:
Torrance, California.
Parts:
Rubber utilities (cups; washers; gaskets; skid wheels; crash pads; plugs; tail wheels; terminals; channel; grommets; bumpers; bushings; rings; belts; shock absorbers; discs; strips; frames; spacers).

Runzel Cord & Wire Co.
4727 Montrose Ave., Chicago, Ill.
John Runzel, Jr.
Material:
Insulation (cord and wire).

D. J. Ryan Foundry
Ecorse, Michigan
Parts:
Castings (steel).

Joseph T. Ryerson & Son, Inc.
18th & Rockwell Sts., Chicago, Ill.
Branch offices:
Exchange Bldg., Kansas City, Mo.; Manufacturers' National Bank Bldg., Rockford, Ill.; 605 Washington Ave., N., Minneapolis; 2035 E. 11 St., Tulsa; State Bank Bldg., Rock Island, Ill.
Service plants:
320 S. 19th St., Milwaukee; 5 Clinton St., St. Louis; 1600 Euclid Ave., Detroit; Front & Freeman Sts., Cincinnati; East 53 & Lakeside Ave., Cleveland; 203 Westside Ave., Jersey City; 5200 Grays Ave., Philadelphia; Bailey Ave. & Stanley St., Buffalo; Third, Binney & Munroe Sts., Cambridge, Mass.
Parts:
Hardware. Tubing (seamless; 18-8 stainless).
Materials:
Steel (cold rolled strip; aircraft strip; shim; 18-8 stainless [sheet, plate]; bar [round, cold drawn, hexagon, square]; alloys [chrome nickel bar, round]).

S

Sanford Mills, Sanford, Maine
Materials:
Carpets. Upholstery. Fabric.

Safetee Glass Company
Wayne Junction, Philadelphia, Pa.
C. A. McCusker, mgr. sales and purchases.
Materials:
Glass (non-shatterable; sound insulating).

Saylor Electric Products Corp.
1014 Lynn Ave., Detroit, Mich.
J. M. Sharkey.
Materials:
Insulation material.

F. Schumacher & Company
60 W. 40th St., New York, N. Y.
W. N. Lee.
Materials:
Upholstery (fabric). Drapery. Carpet.

Scintilla Magneto Co., Inc.
Sherman Ave., Sydney, New York
V. Bendix, pres.; H. Hanni, vice-pres. & gen. mgr.; T. Z. Fagan, vice-pres. in charge sales; W. J. Spengler, chief eng.
Branch office:
230 Park Ave., New York.
Parts:
Shielding.*

Scully Steel Products Co.
21st & Gratiot Sts., St. Louis, Mo.
Materials:
Steel (bar).

Seaboard Brass & Copper Co.
35 S. Gay St., Baltimore, Md.
Parts:
Brass wire and tubing.
Materials:
Brass (sheet).

Sealed Power Corp.
Muskegon, Michigan
N. A. Moore, research and production; W. J. Sheldon, service sales.
Branch offices or warehouses:
326 Ivy St., Atlanta, c/o Jobbers Service; 2620 S. Michigan Ave., Chicago, c/o Automotive Warehousing Corp.; 2857 Forsythe Ave., Detroit, c/o Jobbers Warehouse; 1358 S. Flower St., Los Angeles, c/o Sydney H. Russell, Inc.; 9-11 Jersey St., Boston; 2717 Main St., Dallas, c/o Parts Warehouse Co.; 14 & Oak Sts., Kansas City, Mo., c/o R. O. Smith Motor Parts Warehouse; 1612 Harmon Pl., Minneapolis, c/o Automotive Warehouse; 249 W. 64 St., New York, c/o Auto Parts Warehousing Co.; 408 N. W. 12 Ave., Portland, Ore., c/o Automotive Warehouse Co.; 809 North 19 St., Philadelphia c/o Automotive Parts Warehousing Co.; 552 McAllister St., San Francisco. Canadian Representative: A. H. Fraser & Co., Ltd., 283 King St., E., Toronto, Ont.
Parts:
Pistons. Piston pins. Piston rings. Valves. Valve accessories.

Seaman Paper Company
Chicago, Illinois
D. R. Seaman, vice-pres. in charge sales & advertising; Clayton Seaman, vice-pres. of sales; S. Hazard, Jr., chief eng.
Branch offices:
Chicago; New York and Buffalo, N. Y.
Agents:
Air Associates; Pacific Airmotive Corp.
Materials:
Soundproofing and insulation material (*Seapak*).

Seamlex Corporation
Long Island City, New York
F. F. Jacobson, pres.; C. K. Freeman, director of sales.
Parts:
Flexible tubing (*Seamless* oil and fuel lines [bronze, aluminum or monel to absorb vibration, expansion or flexing]). Shielding (flexible aluminum condit for electrical wiring systems).

The Screw Machine Products Co.
1012 Eddy St., Providence, R. I.
Parts:
Hose clamps.

A. G. Seaver
Denver, Colorado
Materials:
Upholstery (leather and fabric).

Seibert Varnish Company
6455 Strong, Detroit, Mich.
Materials:
Paint. Enamel.

Sewall Paint & Varnish Co.
Kansas City, Missouri
Materials:
Paint.

Shakeproof Lock Washer Co.
2501 N. Keeler Ave., Chicago, Ill.
H. C. Smith, pres.; F. W. England, G. G. Olson, vice-presidents; C. L. Johnson, sec. and treas.; J. M. Gribbe, sales mgr.
Parts:
Lock washers. Self-tapping screws.

Shenango-Penn Molding Co.
Oliver Bldg., Pittsburgh, Pa.
G. L. Collord, vice-pres.
Parts:
Valve guides.

Service Steel Company
1435 Franklin St., Detroit, Mich.
Factory:
Plymouth, Mich.
Branch offices and warehouses:
Buffalo; Cincinnati; Los Angeles.
Parts:
Tubing and tubular products (seamless steel).

The Sherwin-Williams Co.
Midland Bldg., Cleveland, Ohio
R. J. Kidd, in charge of development of oil and synthetic type aviation finishes; G. H. Robertson, sales mgr. aeronautical division, (Cleveland). L. Pereny, lacquer chemist in charge of development on dope and lacquer enamels. (Chicago).
Factories:
115th St. & Cottage Grove, Chicago; 601 Canal Road, Cleveland; Brown St. & Lister Ave., Newark; 1450 Sherwin Ave., Oakland, Calif.
Branch offices and warehouses:
Colonie & Montgomery Sts., Albany; Pratt & Green Sts., Baltimore; 19 Pittsburgh St., Boston; 115 St. & Cottage Grove Ave., Chicago; 410 Commercial Sq., Cincinnati; 1621 Wall St., Dallas; 1960 Milwaukee Ave., E., Detroit; 219 N. Senate Ave., Indianapolis; 2320 Liberty St., Jacksonville; 1520 Grand Ave., Kansas City, Mo.; 701 Third St. N., Minneapolis; 741 Magazine St., New Orleans; Delaware Ave. & Chestnut St., Philadelphia; 55 Water St., Pittsburgh; 1048 6th Ave., S., Seattle; 515 Spruce St., St. Louis; 3170 E. Pico Blvd., Los Angeles; 1450 Sherwin Ave., Oakland, Calif.; Munsey Bldg., Washington, D. C.
Warehouses:
56 Post Office Sq., Bangor, Me.; 37 Pearl St., Buffalo; 267 E. Bay St., Charleston, S. C.; 212 W. First St., Charlotte, N. C.; 236 W. Jefferson St., Louisville; 211 W. 1 St., Oklahoma City; Dodge & 10th Sts., Omaha; 512 W. Jackson St., Phoenix; 64 Traverse St., Providence; 53 West Broadway, Salt Lake City; 610 Folsom St., San Francisco; 655 E. Liberty St., Savannah; 157 S. Post St., Spokane; State Tower Bldg., Syracuse; 118 So. Cheyenne St., Tulsa.
Offices:
Midland Bldg., Cleveland; 292 Madison Ave., New York. Distributor: Nicholas Beazley: Marshall, Mo.; Floyd Bennett Field, Brooklyn, N. Y.; 6235 San Fernando Rd., Glendale, Calif.; Love Field, Dallas, Tex.
Materials:
Dope (clear; pigmented). Thinner. Paint. Enamel. Varnish. Primer. Lacquer enamel and lacquer softener and remover. Wax. Polishing compound Enamel (synthetic; oil base).

Simplex Products Corp.
3830 Kelley Ave., Cleveland, O.
Dean M. Solenberger, pres.; Fred G. Ferguson, vice-pres.; R. C. Thompson, chief eng., Roy T. Parker, service dept.
Branch offices:
1716 So. Grand Ave., Los Angeles; 271 W. 69 St., New York; 2816 Commerce St., Dallas; 445 King St. W., Toronto, Canada. British licensees: Wellworthy, Ltd., Lymington, England.
Parts:
Piston rings (*Simplex* and *Simplex* Mo lium). Piston resizers.

Sitka Spruce Lumber Co., Ltd.
Vancouver, B. C., Canada
J. A. McEachern.
Materials:
Spruce.

SKF Industries, Incorporated
Philadelphia, Pennsylvania
W. L. Batt, pres.; R. F. Runge, vice-pres.; R. H. DeMott, gen. sales mgr.; J. W. Tawresey, asst. chief eng.; Dr. H. Styri, in charge of research laboratory; N. Miller (Atlanta); H. A. Fonda (Boston); H. G. Wallace (Buffalo); R. W. Franklin (Charlotte); J. B. Castino (Chicago); R. R. Zisette (Cincinnati); P. R. Payson (Cleveland); H. L. Gaddis (Dallas); C. R. Mabley (Detroit); W. C. Clingan (Hartford); H. A. Westwater (Kansas City); C. F. Stein (Milwaukee); A. J. Kishkunas (Minneapolis); J. D. Williamson (New York); M. Middleton (Philadelphia); V. A. Menaglia (Pittsburgh).
Factory:
Front St. & Erie Ave., Philadelphia; (ball manufacturing plant) Atlas Ball Co., Glenwood Ave. & American St., Philadelphia.
Branch offices:
598 Peachtree St., N. E., Atlanta; 10 High St., Boston; Genesee Bldg., Buffalo; Johnston Bldg., Charlotte, N. C.; 1242 W. Washington Blvd., Chicago; 1017 Main St., Cincinnati; 3912 Carnegia Ave., Cleveland; 2820 E. Grand Blvd., Detroit; 410 Asylum St., Hartford; 101 E. 24 St., Kansas City, Mo.; 1114 S. Hope St., Los Angeles; Plankinton Bldg., Milwaukee; 407 S. Fourth St., Minneapolis; 1976 Broadway, New York; Glenwood Ave. & American St., Philadelphia; Grant Bldg., Pittsburgh; 209 S. W. 9th Ave., Portland, Ore.; 221 Eleventh St., San Francisco; 410 N. St. Paul St., Dallas.
Parts:
Bearings (ball; deep groove, self-aligning; roller; control pulley).

Sligo Iron Store Co.
1301 N. 6th St., St. Louis, Mo.
Materials:
Steel.

Solar Aircraft Co., Ltd.
Lindbergh Field, San Diego, Calif.
E. T. Price, pres.; L. E. Wheeler, vice-pres.; C. S. Marston, vice-pres. & sec.; A. W. Briggs, treas.; J. Seamons, chief eng.; W. P. Clark, supt.
Parts:
Exhaust collector rings (fabricated from stainless steel, soft iron and Inconel).*

(Continued on following page)

CURTISS WRIGHT TRAINER

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General is proud to play a part in maintaining the reputation that Curtiss Wright trainers have achieved. General has solved the tire problem for a long list of the nation's foremost manufacturers and pilots. It will pay you to submit your problem to General—the air minded company that originated and perfected the famous streamline tire.

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SWITLIK PARACHUTE & EQUIPMENT CO., TRENTON, N. J.

SWITLIK
SAFETY CHUTES

Manufacturers of Fabricated Parts and Aircraft Materials

(continued)

Spaulding Fibre Co.
Tonawanda, New York
E. A. Russell, asst. gen. mgr. Branch managers: (Boston) R. A. Langley (Chicago) H. E. Giddies. (Newark) W. C. Hyde. (St. Louis) C. D. MacRae. (Bridgeport) W. J. Calhoun. (New York) R. S. Christie. (Detroit) C. M. Metelski. (Cincinnati) G. F. Anderson. (Philadelphia) C. F. Kreger. (Cleveland) G. E. Calhoun. (Milwaukee) R. J. Rowland. (Fort Wayne) W. H. Grahame.
Branch offices:
15 Elkins St., Boston; 659 W. Lake St., Chicago; 40 Clinton St., Newark; 1516 Locust St., St. Louis; 952 Main St., Bridgeport; 484 Broome St., New York; 1010 Beaubien St., Detroit; 311 E. 8 St., Cincinnati; 141 N. 4th St., Philadelphia; 1213 W. 3 St., Cleveland; 207 E. Michigan St., Milwaukee; Old-First Bank Bldg., Fort Wayne.
Parts:
Fibre (fabricated). Insulation (*Armite* fabricated).
Materials:
Fibre (hard vulcanized sheet; rod; tube). Insulation (*Armite* coil; sheet).

Standard Brass Mfg. Co.
1300 Chestnut St., Kansas City, Mo.
Parts:
Castings (aluminum).

Standard Screw Co., Chicago, Ill.
Branch offices:
Detroit Screw Co., 1469 E. Atwater St., Detroit.
Parts:
Nuts and bolts.

Standard Steel Specialty Co.
Beaver Falls, Pennsylvania
Parts:
Hardware (taper pins).

E. J. Stanton & Sons
Los Angeles, California
Materials:
Wood (spruce; balsa).

The Stearman Aircraft Co.
Wichita, Kansas
J. E. Schaefer, pres. and gen. mgr.; Mac Short, vice-pres. and chief engineer; H. F. Brown, factory supt.; J. P. Murray, vice-pres.; Lewis G. Sinning, purchasing agent.
Parts:
Collector rings. Exhaust stacks. Manifolds. Streamlinings. Fuel tanks.

Steelcote Manufacturing Co.
3418 Gratiot St., St. Louis, Mo.
G. E. Niedt, pres., gen. mgr., and purchasing agent; A. E. Niedt, vice-pres., treas., and gen. sales mgr.; A. G. Schroeck, sales mgr.
Materials:
Enamel (rubber). Lacquer. Paint. Varnish.

Steel Improvement & Forge Co.
960 Addison Rd., Cleveland, Ohio
C. H. Smith, pres.
Parts:
Forgings (steel).

Steel Products Engineering Co.
Springfield, Ohio
W. C. Jordan, sales mgr.
Parts:
Hardware.

Steel Sales Corporation
129 S. Jefferson St., Chicago, Ill.
J. A. Roesch, pres.; F. W. Walters, vice-pres.
Branch offices:
4150 W. Virginia St., Milwaukee; 529 S. 7th St., Minneapolis.
Parts:
Aluminum rivets. Spring wire.
Materials:
Aluminum and aluminum alloys (flat sheets; bar; rod). Steel (SAE; tube). Copper (tube). Inconel (sheet).

Stewart-Warner-Alemite Corp.
Chicago, Illinois
Parts:
Fittings. Hardware.

E. B. Stimpson Company
Kent Ave., Brooklyn, N. Y.
Parts:
Washers (brass; copper).

Suncook Mills
34 Thomas Street, New York, N. Y.
(At Suncook, N. H.) W. Rodman Peabody, pres.; J. Linzee Weld, treas.; S. B. Potter, asst. treas. (At New York) V. Dietz, Jr., sales mgr.
Factories:
Yardley, Pa.; Suncook, N. H.
Branch office:
10 State St., Boston.
Materials:
Fabric (*Flightex Grade A* covering; balloon fabric; lightweight covering; glider fabric; manufactured to A & N specifications). Tape (*Flightex* pink and straight edge; pink and straight edge light weight; glider; reinforcing; manufactured to A & N specifications).

Sun Rubber Company
Barbeton, Ohio
Materials:
Rubber utilities.

Summerill Tubing Company
Bridgeport, Pennsylvania
E. L. Parker, pres.; J. P. Boore, vice-pres.; H. M. Brightman, asst. to pres.; N. H. Wolf, gen. mgr.; G. P. Kraemer, sec. & treas.; J. P. Dods, mgr. of sales; R. R. Lawson, gen. superintendent; T. Heske, production mgr.
Distributor and sales representative:
Edgar T. Ward's Sons Co., 44 Farnsworth St., Boston; 39 River St., Buffalo; 4840 S. St. Louis Ave., Chicago; 1210 E. 55th St., Cleveland; 1300 Fort St. W., Detroit; 400 Frelinghuysen Ave., Newark; Cedar & Westmoreland St., Philadelphia; Woodkirk St., Pittsburgh. Pacific Coast Representative: Foucar, Ray & Simon, Inc., San Francisco; Baker Steel & Tube Co., Los Angeles. Canadian Representative: B. W. Deane & Co., Ltd., Montreal; Robert W. Bartram, Ltd., Montreal.
Parts:
Tubing (chrome-molybdenum seamless steel; round, streamline; square, oval).

Superior Foundry Company
Cleveland, Ohio
Parts:
Castings (iron).

Superior Metal Spinning & Mfg. Co.
4063 Fitch Rd., Toledo, O.
E. Berninger.
Parts:
Cowlings.

Superior Piston Ring Co.
6426 Epworth Blvd., Detroit, Mich.
Walter Lightheiser, pres.
Parts:
Piston rings

Superior Steel Corporation
Pittsburgh, Pennsylvania
Materials:
Steel (sheet).

T

Don Tallmadge Company
132 W. 14th St., New York, N. Y.
Materials:
Upholstery (fabric).

H. D. Taylor, Buffalo, N. Y.
Materials:
Upholstery (leather). Upholstery supplies.

Teicher Manufacturing Co.
Long Island City, N. Y.

A. A. Teicher, pres.
Parts:
Sheet metal accessories (aluminum; dural; stainless steel; [pilot seats; cowlings; handhole covers, fairings, spinnings, fillets, wheel housings]).

Technical Coatings, Inc.
11 Park Place, New York, N. Y.
Materials:
Paint.

Tennessee Eastman Corporation
Kingsport, Tennessee
Materials:
Plastics (cellulose acetate *Tenite*).

Thiokol Corporation
Yardville, New Jersey
Dr. J. C. Patrick; Harry Ferguson.
Branch offices:
Mowsanto Chemical Co., Ltd., London, England; Furukawa Electric Co., Yokohama, Japan.
Parts:
Hose (gasoline and oil servicing; lubricating system). Gaskets. Washers.
Materials:
Gasoline tank sealing material. Fuselage sealing material. Balloon cloth.

J. H. Thorp & Company
250 Park Avenue, New York, N. Y.
Materials:
Carpeting.

Thresher Varnish Co., Dayton, O.
P. W. Blue, asst. sales mgr.
Materials:
Varnish. Enamel. Lacquer. Primer. Surfacer.

Thomas Wire & Spring Co.
Hoboken, New Jersey
Parts:
Springs.

Thompson Products, Inc.
2196 Clarkwood Rd., Cleveland, O.
F. C. Crawford, pres.; L. M. Clegg, vice-pres. & gen. mgr.; A. T. Colwell, director of engineering; J. R. Cox, director of manufacturing; E. C. Williams, director of purchasing.
Parts:
Valves. Valve seat inserts. Valve tappets. Valve retainer locks. Piston pins.

Thurston Cutting Corp.
40 Worth St., New York, N. Y.
W. Harris Thurston, pres.
Materials:
Covering (fabric).

Timken Roller Bearing Co.
Canton, Ohio
L. M. Klinedinst, vice-pres. in charge sales; W. B. Moore, gen. mgr.
Factories:
Canton, Columbus, Mt. Vernon and Wooster, Ohio.
Branch offices:
Birmingham; Boston; Buffalo and New York; Chicago; Cincinnati, and Cleveland; Dallas; Detroit; Huntington, W. Va.; Milwaukee; Philadelphia and Pittsburgh; San Francisco; Seattle; St. Louis; Toronto, Canada; Washington, D. C.
Parts:
Ball bearings (single and double row; thrust; tapered).

Timken Steel & Tube Co.
Canton, Ohio
Parts:
Steel tubing (seamless alloy).
Materials:
Steel (bar).

Titan Metal Manufacturing Co.
Bellefonte, Pennsylvania
Materials:
Brass and bronze.

Titanine, Inc., Union City, N. J.
E. G. Davis, pres. & gen. mgr.; W. A. Bagley, sales mgr. & asst. treas.
Materials:
Dope (*Ti-two* semi pigmented). Lacquer. Enamel. Varnish. Thinner. Reducer. Retarder.

Titeflex Metal Hose Co.
Frelinghuysen Ave., Newark, N. J.
C. W. Fletcher, pres.; R. H. Stone, vice-pres.; E. E. Husted, sales mgr.; H. L. Maring, purchasing agent; M. A. Brisinger, engineering department.
Branch offices:
General Motors Bldg., Detroit; Hippodrome Bldg., Cleveland; Merchandise Mart, Chicago; Bourse Bldg., Philadelphia; 950 Van Ness Ave., San Francisco; 49 Federal St., Boston; Walbridge Bldg., Buffalo.
Parts:
Tubing (*Titeflex* flexible metal). Hose (*Titeflex* flexible metal). Exhaust tubing (all-metal).

Tonk Brothers Company
Chicago, Illinois
Paul H. Monnig, pres.; J. Kulicek.
Parts:
Wire (steel).

The Torrington Co.
Torrington, Connecticut
F. T. Case, sales mgr., bearings department.
Factories:
South Bend, Ind.
Branch offices:
Stephenson Bldg., Detroit; 538 S. Wells St., Chicago; 1640 Fairmount Ave., Philadelphia; 321 W. Pico St., Los Angeles; 806 Ellis St., San Francisco; 200 Fifth Ave., New York; Caxton Bldg., Cleveland.
Parts:
Ball bearings (open and closed type; shielded). Needle bearings. Metal specialties.

Tsungani Piston Company
Tacoma, Washington
Parts:
Pistons.

Tubular Service Corporation
120-44th St., Brooklyn, N. Y.
A. W. Brand.
Parts:
Tubing (steel).

U

Union Drawn Steel Co.
Massillon, Ohio
R. J. Wysor, pres.; L. E. Creighton, vice-pres.; F. C. Young, gen. sales mgr.; R. B. Barnett, asst. gen. sales mgr.
Factories:
Beaver Falls, Pa.; Hartford, Conn.; Gary, Ind.
Branch offices:
Birmingham; Buffalo; Chicago; Cincinnati, Cleveland and Dayton, O.; Denver; Hartford; Houston; Indianapolis; Los Angeles and San Francisco, Calif.; Milwaukee; Philadelphia and Pittsburgh, Pa.; Salt Lake City; St. Louis; St. Paul; Seattle; Tulsa.
Parts:
Crankshafts (steel).
Materials:
Steel (cold drawn carbon; stainless; alloy).

United Aircraft Products, Inc.
Dayton, Ohio
T. M. Hiester, pres.; Joseph G. Lehman, treas.; R. G. Dykeman, chief eng.
Parts:
Fuel system installations. Accessories (armament; fuel system). Electrical conduit fittings.*

United Carr Fastener Corp.
31 Ames St., Cambridge, Mass.
Sinclair Week, pres. & treas.; Preston Upham, vice-pres.; A. S. Boynton, sec.; A. W. Kimbell, gen. mgr.; G. S. Maynard, gen. sales mgr.
Parts:
Snap fasteners. Metal stampings.

United Metal Hose Company
734 Garrison Ave., New York, N. Y.
Parts:
Tubing (flexible).

U. S. Flexible Metallic Tubing Co.
65 Main St., San Francisco, Calif.
F. A. McDonald, mgr.
Factory:
Pennsylvania Flexible Metallic Tubing Co., 72nd & Powers Lane, Philadelphia.
Branch offices:
454 E. 3 St., Los Angeles; 512 1 Ave., S., Seattle; Portland, Ore.
Parts:
Flexible tubing.

U. S. Foundries, Inc.
3975 Williams St., Denver, Colo.
Parts:
Castings (steel).

U. S. Graphite Company
Holland Ave., Saginaw, Mich.
A. Harvey, pres.; H. Randall Wickes, vice-pres.
Branch offices:
New York; Philadelphia and Pittsburgh; Chicago; St. Louis.
Parts:
Steel bushings and bearings (self-lubricating).

(Continued on following page)

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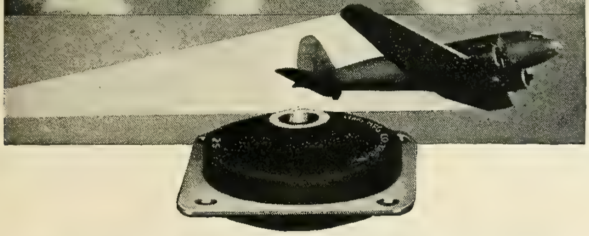

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U. S. Hammered Piston Ring Co.
Paterson, New Jersey
A. Wenzel, pres.; A. Sandouw, sec.
Parts:
Piston rings.

U. S. Plywood Company
103 Park Ave., New York, N. Y.
J. P. Dunne, mgr. aircraft division.
Materials:
Plywood.

United States Rubber Products, Inc.
1790 Broadway, New York, N. Y.
J. A. Faucher, tire sales; H. A. Everlein, mechanical rubber utilities.
Factories:
Providence; Naugatuck, Conn.; Passaic, N. J.; Detroit; Los Angeles.
Branch offices:
204 Walker St., S. W., Atlanta; 429 S. Charles St., Baltimore; 5 N. 20 St., Birmingham; 560 Atlantic Ave., Boston; 133 Swan St., Buffalo; 440 W. Washington St., Chicago; 1101 Central Parkway, Cincinnati; 1235 W. 6 St., Cleveland; 1039 Young St., Dallas; 875 Broadway, Denver; 521 W. Second St., Davenport; 6670 E. Jefferson Ave., Detroit; 1407 Park St., Hartford; 1312 Franklin Ave., Houston; 590 E. Louisiana St., Indianapolis; 313 W. 8 St., Kansas City, Mo.; 784 San Pedro St., Los Angeles; 345 2nd St., Memphis; 447 N. Water St., Milwaukee; 500 S. 3rd St., Minneapolis; 202 Fulton St., New Orleans; 675 11 Ave., New York; 901 Douglas St., Omaha; 5th & Locust St., Philadelphia; 601 General Robinson St., Pittsburgh; 435 N. W. 6th St., Portland, Ore.; 309 W. Martlin St., Raleigh; 1015 Washington St., St. Louis; 160 Motor Ave., Salt Lake City; 300 Second St., San Francisco; 212 Jackson St., Seattle; 1011 First Ave., Spokane; 125 Marcellus St., Syracuse.
Parts:
Rubber utilities (gaskets; packing; tubing; oil, water, fuel hose; rubber matting; grommets; rings; bumpers; pedal pads; flexible pipe; control wheels; washers). Artificial leather.*

U. S. Steel Corp., Pittsburgh, Pa.
J. C. Eckel.
Materials:
Steel (sheet *USS* stainless).

United Wire & Supply Corp.
Providence, Rhode Island
Parts:
Seamless tubing (instrument capillary; non ferrous).

Universal Steel Company
Bridgeville, Pennsylvania
Materials:
Chrome molybdenum (sheet; strip).

Unyte Corporation
521 Fifth Ave., New York, N. Y.
Materials:
Plastics (urea-formaldehyde *Unyte*).

V

Valentine & Company
New York, New York
C. E. Whipple; T. W. Colton.
Materials:
Paint. Varnish.

The Vellumoid Co., Worcester, Mass.
G. C. Beals, treas. & gen. mgr.; C. S. Livingstone, sales mgr.; L. Wald, plant mgr.
Factories:
105 Scotten Ave., Detroit.
Parts:
Sheet packing. Gaskets.

Victor Mfg. & Gasket Co.
5750 Roosevelt Road, Chicago, Ill.
J. H. Victor, pres.; J. B. Victor, vice-pres.; C. C. Secrist, sec. & sales mgr.; G. A. McAninch, treas.; I. M. Larson, purchasing agent; A. Frymark, general mgr.
Parts:
Gaskets (copper asbestos; steel; asbestos; treated paper; cork; compressed asbestos; solid metal). Packing (treated paper *Victorite*, compressed asbestos sheet *Victopac*, cloth insert cork sheet *Corkolin*). Oil seals (metal encased leather; felt; cork; synthetic diaphragms).

W

Wailes Dove-Hermiston Corp.
17 Battery Place, New York, N. Y.
Materials:
Finishes.

Wallace & Gale Co.
115 S. Gay St., Baltimore, Md.
Materials:
Asbestos.

Warman Steel Casting Co.
Boyle Ave., Los Angeles, Calif.
Parts:
Castings (steel).

Edgar T. Ward's Sons Co.
Newark, New Jersey
Materials:
Steel.

Waterbury Button Company
Waterbury, Connecticut
Parts:
Rivets (aluminum and steel).

Weatherhead Company
632 Frankfort Ave., Cleveland, O.
Walter F. Brown.
Materials:
Rubber.

Weyerhauser Forest Products Corp.
St. Paul, Minneapolis
Materials:
Balsam wood.

Wellington Sears Co., Inc.
65 Worth St., New York, New York
Branch offices:
Trust Company of Georgia Bldg., Atlanta; 220 Devonshire St., Boston; 222 West Adams St., Chicago; Whitney Central Bldg., New Orleans; 417 Market St., San Francisco; 119 S. 4th St., Philadelphia; Penobscot Bldg., Detroit; Insurance Exchange Bldg., St. Louis.
Materials:
Fabric (*HH* balloon cloth; *BA-30* covering; *BA-24* light-weight covering; *S 395* glider cloth). Tape *BA30* and *HH* (pinked).

Western Felt Works, Chicago, Ill.
Branch offices:
42 E. 20th St., New York; 3118 N. Broad St., Philadelphia; Stephenson Bldg., Detroit; 750 Prospect Ave., Cleveland; 519 Main St., Cincinnati; Ambassador Bldg., St. Louis; Second Unit Santa Fe Bldg., Dallas; 762 E. Pico St., Los Angeles; 1239 Howard St., San Francisco; 712 Fourth St., Seattle; 14 S. W. 5th Ave., Portland, Ore.; 1660 11 St., Denver; 369 Cabot St., Newtonville, Mass.
Parts:
Felt (fabricated valve rocker oiling pad; cowling rocker box vibration absorbers).
Materials:
Felt (soundproofing and vibration deadening sheet; roll; leather-coated insulation sheet).

Western Gasket & Packing Co.
340 Crocker, Los Angeles, Calif.
Parts:
Gaskets.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pennsylvania
Factories:
East Pittsburgh; Attica, N. Y.; Chicopee Falls, Mass.; Cleveland; Derry, Pa.; East Springfield, Mass.; Emeryville, Calif.; Mansfield, O.; Newark; Pittsburgh; St. Louis; Sharon, South Philadelphia.
Branch offices:
Phoenix, Ariz.; Los Angeles; Oakland; San Francisco; New Haven; Wilmington; Washington, D. C.; Jacksonville; Tampa; Atlanta; Chicago; Peoria; Evansville; Indianapolis; Des Moines; Sioux City; Waterloo; Wichita; Augusta; Bangor; Baltimore; Boston; Springfield; Worcester; Flint; Detroit; Grand Rapids; Duluth; Minneapolis; St. Paul; St. Louis; Butte, Mont.; Omaha; Newark; Trenton; Albany; Binghamton, New York; Rochester; Syracuse; Utica; Charlotte; Raleigh; Cleveland; Toledo; Oklahoma City; Tulsa; Portland, Ore.; Allentown; Philadelphia; Reading; York; Providence; Columbia; Greenville, S. C.; Memphis; Burlington, Vt.; Richmond; Dallas; Ft. Worth; Houston; San Antonio; Seattle; Spokane; Madison, Wisc.
Parts:
Micarta products (control pulleys; fairleads; bushings; bearings, instrument and terminal boards; cabin lining) Electrically-operated fuel valves. Insulating (cotton and treated cloth; treated fabric; paper; mica). Cement. Compound. Micarta (gears; panels; sheets; tubing; channels; angles).*†

Taylor Wharton Iron Steel Co.
Easton, Pennsylvania
Parts:
Cylinder barrels

Wheeling Corrugating Co.
Wheeling, West Virginia
Materials:
Cop-R-Loy. Steel. Wire. Sheet. Tin plate.

Whitehead Metal Products
304 Hudson St., New York, N. Y.
Parts:
Flat sheets.

Wm. Whitman Company
261 Fifth Ave., New York, N. Y.
Materials:
Fabrics.

Wichita Wire Products Co.
Wichita, Kansas
D. E. Varner.
Parts:
Coil springs. Cowling lock pins.

White Supply Company
St. Louis, Missouri
Materials:
Fibre.

Whitehead Stamping Co.
W. Lafayette Blvd., Detroit, Mich.
J. F. Whitehead, pres.
Parts:
Stampings. Washers (standard and to specifications).

Wm. Wiese & Co., Inc.
234 W. 56th St., New York, N. Y.
W. Wiese, pres.; C. A. Wiese, vice-pres.; M. W. Wiese, sec.
Materials:
Upholstery (cabin interiors). Carpeting Curtain silk.

Wilcox-Rich Corp., Detroit, Mich.
C. W. Miller, pres.; F. A. Buchda, sec.-treas.; R. Jardine, chief eng.; H. G. Johnson, sales mgr. (Rich division).
Factories:
Battle Creek and Saginaw, Mich.
Parts:
Valves (*Rich* salt-cooled). Valved seat inserts.

Wilkening Manufacturing Co.
2000 S. 71st St., Philadelphia, Pa.
F. W. Wilkening, pres.; G. L. Briggs, executive vice-pres.; E. C. Chatfield, sales mgr.
Parts:
Piston rings (*Pedrick*). Packing (valve stem). Compressors (piston ring).

J. H. Williams & Co.
75 Spring St., New York, N. Y.
J. H. Williams, pres.; A. D. Armitage, vice-pres. (Buffalo); J. C. Scanlon, mgr. special forgings division (Buffalo); W. H. Blocksidge, chief metallurgist (Buffalo).
Factory:
Buffalo.
Branch offices:
117 N. Jefferson St., Chicago; 400 Vulcan St., Buffalo.
Parts:
Drop forgings for aircraft and aircraft engines heat-treated to specifications Drop-forged wrenches and tools.

Williams & Company, Inc.
Pennsylvania Ave., Pittsburgh, Pa.
E. C. Edmundson, sales mgr.
Materials:
Aluminum (flat sheets).

Wittek Mfg. Co., Chicago, Ill.
J. Wittek, pres.; B. A. Petzloff, sec.-treas., & gen. mgr.
Parts:
Hose clamps (*Noc-Out*).

Wilmington Fibre Specialty Co.
Wilmington, Delaware
J. W. Morris, pres.; M. L. K. Armstrong, treas.; H. M. Romig, sales mgr.; F. L. Gerhauser, production mgr.
Factory:
New Castle, Delaware.
Branch offices:
838 W. Congress St., Chicago; 3969 Kenkel Ave., Cincinnati; 1514 Prospect Ave., Cleveland; Colorado Bldg., Denver; 8624 Gratiot Ave., Detroit; 1001 E. First St., Los Angeles; 16 E. Hennepin Ave., Minneapolis; 30 Vesey St., New York; 401 N. Broad St., Philadelphia; 405 Penn Ave., Pittsburgh; Temple Bldg., Rochester; 134 Pierpont Ave., Salt Lake City; Tilden Sales Bldg., San Francisco; Central Bldg., Seattle; Second National Bank Bldg., Toledo; 155 Clearfield Rd., Hartford.
Materials:
Fibre (sheet; tubing; round rod). Insulation (*Ohmoid* sheet; rod; tube; special shapes).

Worcester Stamped Metal Co.
Worcester, Massachusetts
H. O. McCauley.
Parts:
Stampings.

Wolverine Tube Company
1455 Central Ave., Detroit, Mich.
Parts:
Tubing (copper).

Wood Conversion Co.
St. Paul, Minnesota
D. H. Corlette; R. E. Backstrom.
Materials:
Balsam wool. Soundproofing material. Insulation material.

Woodcraft Corp., Bay City, Mich.
Materials:
Plywood.

Worcester Pressed Steel Co.
Worcester, Massachusetts
Parts:
Stampings.

Worcester Taper Pin Co.
May St., Worcester, Mass.
Parts:
Hardware (taper pins).

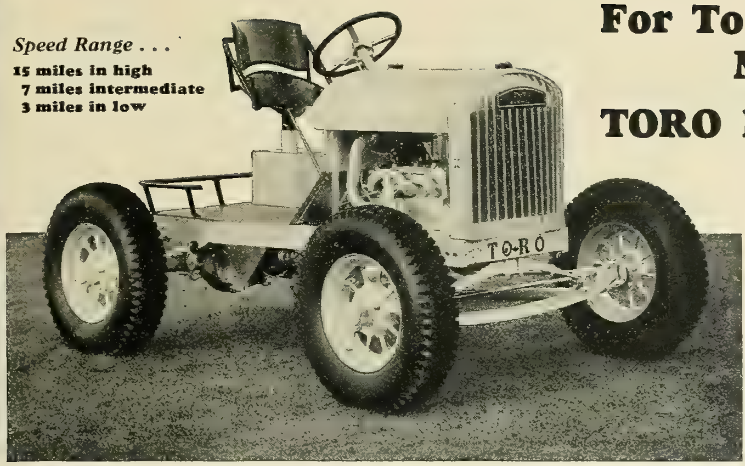
Wyman-Gordon Co.
Worcester, Massachusetts
J. H. Nelson, chief eng.; F. E. Wellington, mgr.; R. W. Stoddard, ass't. mgr. aviation division.
Branch offices:
Book Bldg., Detroit.
Parts:
Forgings (steel [crankshafts; connecting rods; link rods; cam rims; propeller shafts; propeller hubs; cylinder heads; barrels; spiders]; aluminum [pistons; crankcases, propellers]).

Y

Yoho & Hooker, Youngstown, Ohio
John Yoho.
Materials:
Wood (plywood; spruce).

Yost Superior Co.
Springfield, Ohio
Parts:
Springs.

L. A. Young Spring & Wire Co.
9200 Russell St., Detroit, Mich.
Parts:
Springs.



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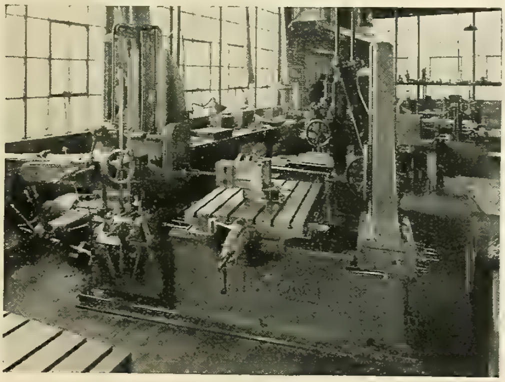

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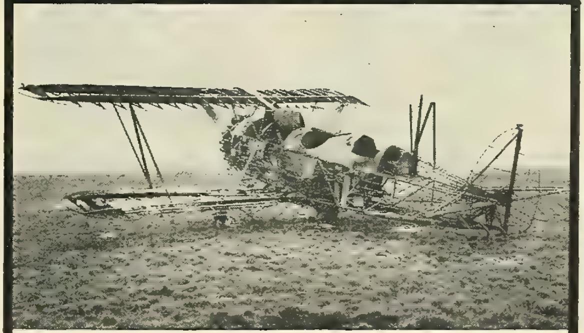

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Personairlities

By Caldwell

● Col. Edgar S. Gorrell is president of the Air Transport Association of America, and it is his duty to make the various airlines of our nation lie down peaceably together like Clyde Beatty's lions and tigers. It's a good trick if he can do it. He is sometimes referred to as the Czar of Aviation, but you recall what happened to the Czar of Russia.

However, if anyone can get away with it, E. S. Gorrell seems to be the man. Not that he's so very impressive to look at, for in general appearance and manner he bears a strong resemblance to an amiable shoe salesman anxious to please. He has an ingratiating way about him that is very effective with Senators and Congressmen. I have watched him work on both specimens of the *genus homo,* and he talks to them just as he would to another human being. That flatters their vanity, and they warm right up to him.

It was at the Senate Hearings and the Hearings before the House Appropriations Committee that I listened to Mr. Gorrell working on the Washington *fauna,* and I want to tell you he did a good job. Smooth, earnest, constructive—that was the line. Not a word of complaint, no calling a spade a low-down dirty spade; no calling Jim Farley what he obviously is, or anything like that. Mr. Gorrell, representing the airline operators, merely asked for what ground aids the airlines need—some $14,000,000 for improvements, he mentioned casually. He also educated the Congressmen—as much as you can educate a Congressman—about aviation. At the end of his testimony he apparently had those noble representatives of the Pee-pul eating out of his hand. I say apparently, because you never know with those fellows—eat out of your hand one minute and bite it the next. Only when he became a Congressman did the Honorable Zioncheck reach the full flower of his genius.

Edgar S. Gorrell was born in Baltimore in what he calls "the early nineties," and if he doesn't want to pin himself down to a birthday it's all right with me. He's been around long enough to lose most of his hair, anyhow. After graduation from the Baltimore public schools he entered the Baltimore City College in September, 1904. He couldn't very well have entered college much before the age of 14, so we'll just put him down as born 1890, or maybe in the late eighties, and let it go at that. He put in three years at college and then, learning that one could get educated for nothing by the taxpayers, he took the entrance examinations for West Point in December, 1907 and entered that august seat of learning and squad drill in February, 1908, graduating in June, 1912, with high scholastic standing. He was also broadswords champion at the Academy, for in 1912 the General Staff still thought that wars would be fought with swords.

Colonel Edgar Gorrell

Gorrell spent two years with the infantry, which was obligatory at that time, and then transferred to the Aviation Section of the Signal Corps at Coronado, Calif., where all aviation activities of the Army were concentrated—the Army's two airplanes were there. Gorrell immediately learned to fly, in 1914—he was Adjutant of the entire Air Service activities at that time. In 1915 he was granted Expert Pilot's License No. 39 in the United States, and F.A.I. License 324. This was positive proof that he could get up and get down again after doing two figure eights in the air. In 1915 he prepared an airplane to fly from the World's Fair in San Diego to San Francisco, but the government stopped him on the grounds that it was too dangerous.

Gorrell, a Lieut. in 1915, offered to be the first Army officer to make a live jump with a parachute which had been tested many times with sand-bags. Luckily for him the commanding officer decided that one more test with a sand bag should be made. The drop was made, the parachute failed to open, and the sandbag instead of Gorrell was scattered about the premises. I've always felt that the Air Corps would have been ahead of the game if Brigadier General "Sue" Claggett had made that test jump.

In January 1916 the non-jumping parachute jumper joined the First Aero Squadron at San Antonio, Texas, the first aerial squadron ever to operate with U. S. Army troops. In March, Pancho Villa started to cut up along the border, but instead of simply sending the amiable Gorrell down to argue with Pancho, who was quite as simple as a Congressman, the government sent a whole flock of Americans chasing after him with guns, calling them a Punitive Expedition, under General Pershing. All they got for their pains was sore feet and fleas, for Pancho laughed and kept moving.

Back to the cultured halls of Massachusetts Institute of Technology came Lieut. Gorrell to take a course in aeronautical engineering. Gorrell sat at the feet of science to take a year's course and get his Master of Science degree. He arrived in September, and by December had learned all the useful stuff and passed with honors.

Then came the time when the United States went Zioncheck and joined the European tribal squabble on the understanding that the American taxpayer was to foot all the bills.

Lieut. Gorrell, packed with M.I.T.'s best brand of aeronautical information, began the war in Washington in the Office of Chief Signal Officer, taking an active part in planning for America's participation in the air Olympics against Germany and for the defense of this country in case the Germans got this far. In June 1917 he was appointed by the Secretary of War to the "Bolling Mission", which under Col. Bolling visited the allied countries to determine what aerial material should be built in the

(*Continued on page* 112)

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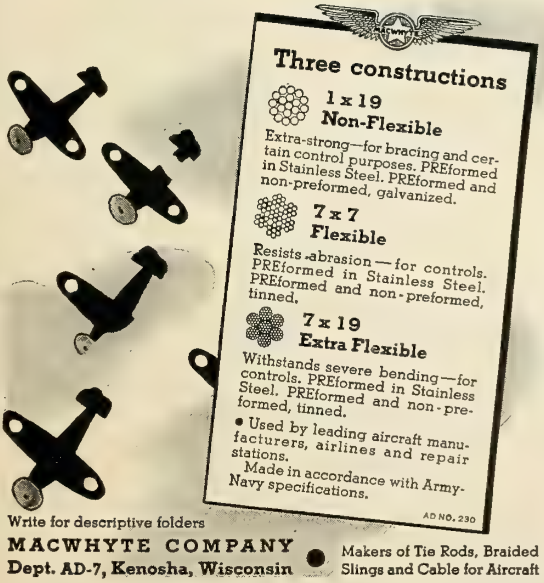

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STATE AVIATION ASSOCIATIONS

●

New Jersey

In May a group of 41 plane owners, pilots and others associated with the aviation industry, residents of and operators in the state of New Jersey assembled to discuss the advisability of forming a non-political state aviation association. With opinion united in favor of such an organization, plans were made for the first official business meeting which was held June 16 at the Robert Treat Hotel, Newark, 70 charter members attending.

Total initial membership at the time of the first business meeting was 126, with 60 additional pledges. Present indications are that memberships will number 500 by July 1.

Officers are: president, Grove Webster, publisher of the *Airport Directory*. Mr. Webster, who has been flying since the war, is one of the most active participants in New Jersey aeronautics; vice-president is Russell C. Johns, advertising manager of AERO DIGEST; secretary-treasurer is H. Myers Bogert, president of Standard Aviation, Inc., operators of Teterboro Airport. Those officers also comprise the executive committee.

Major points of the New Jersey State Aviation Association's practical and flexible constitution, are outlined here, briefly, for study by other states considering formation of similar organizations:

Purpose: To create a non-profit, non-political state organization interested in the promotion, protection and development of aviation in New Jersey; and to cooperate with State and Federal agencies in promoting sane and reasonable legislation equitable to all who fly within the state.

Government and Management: Shall be vested in a Board of Directors consisting of the president, vice-president, and secretary-treasurer, and 21 County Directors, one from each of the 21 counties of the state. Directors shall be appointed by the president until the membership of any county reaches 10, after which they shall be elected by the members.

Duties of Officers and Directors: President and vice-president, usual. Secretary-Treasurer shall perform usual duties, including paying of all bills conforming to budget prepared by executive committee. This committee at no time shall make any financial commitments in the name of the association except for funds already in the treasury, unless guaranteed by themselves personally.

County Directors: Shall be responsible for the growth of the Association in their respective counties; and shall inform the secretary-treasurer of all matters pertaining to aviation within their counties.

Meetings: Annual Meeting shall be held at a place selected by the executive committee the last Tuesday in June of each year. At all meetings a quorum shall consist of one-fourth of the members in attendance.

Board of Directors shall hold its annual meeting immediately after the annual meeting. Special meetings of the Board may be held at any time on call of the president or vice-president, or on request of a majority of the Board. The Board may at any time and upon the request of a majority of its members conduct a mail ballot of the association on any question affecting the membership as a whole. A majority of such ballots cast shall be binding on the Board and Executive Committee.

Membership Eligibility: Any resident of New Jersey. Any non-resident engaged in the aviation industry within the state. Any non-resident who stores or maintains an airplane within the state.

Committees: Affairs of the association shall be conducted by special or permanent committees appointed by the Executive Committee and/or president, and shall be responsible to them.

By-Laws and Amendments: The Board of Directors may adopt by-laws for further government, providing such by-laws are in conformity with the constitution.

Amendments may be made by the Board of Directors at the request in writing to the Board of at least ten members of the association. In the event an amendment or request is denied by the Board, they shall submit the amendment to a mail ballot of the membership. The amendment shall be adopted if at least two-thirds of the votes cast favor it.

It was decided to depart from the conventional formality and rigidity of schedule usually associated with this type of organization, in order to encourage active participation by every member. Business meetings will be held three or four times a year, at the discretion of the executive committee, with informal round-table dinner discussions in the intervals between.

Primarily social gatherings, these round-table meetings are planned to better acquaint members from the various counties with each other; and to promote a mutual understanding between pilots, operators, mechanics, etc., in the state, of their respective problems. To further stimulate interest in N. J. S. A. A. at these affairs, the first of which is tentatively scheduled for August 4, prominent aeronautical personages will address the group on topics of timely interest.

Member

NEW JERSEY

N J

State Aviation Association

Emblem of the New Jersey State Aviation Association

Dues are $1 a year. In addition to membership card, this fee includes the association's pin and decalcomania emblem for the members' planes or cars. The decalcomania which includes the pin design is reproduced here with the suggestion that other states follow the general scheme so that a certain uniformity may exist among the insignia of all state associations.

New York

With closing of the legislative session, Max J. Pollet, president of New York State Aviation Ass'n., reports on work done.

In conjunction with proposed uniform aeronautics regulation as drawn by Senator Feld, a committee of ass'n. members recommended acceptable legislation. However, the bill as presented was objectionable and letters, telegrams and personal talks with legislators by members was responsible for killing the bill in Assembly after having passed the Senate.

The ass'n. is not just opposed to all legislation, but to any legistion which would cripple the industry. It endorses formation of an aviation commission. Present membership is 1026, with 26 active chapters. Letters will be sent at intervals to members acquainting them with the association.

Virginia

Virginia Aviation Ass'n. has been formed under a constitution and by-laws similar to those of the New York State Aviation Ass'n. A. W. Card is president, and a drive is under way to augment membership.

Maine

Measure to create aviation director of state was defeated when more than 100 members of the Aero Club of Maine went to the capitol to voice their objections. This organization has between 300 and 400 members, with Albert Johnson, director of Portland City Airport, acting as secretary.

Michigan

State Board of Aeronautics is rendering good service in issuing mimeographed reports concerning condition of airports in the state. Five pages of information were available for distribution May 15, giving data on 122 fields. Although an association under state control, Michigan Board sets good examples for private associations' guidance.

Florida

Planned to interest state, county and municipal officials, as well as influential citizens, in the problems and progress of aviation, a state-wide conference will be held July 9-10 in Orlando, Fla.

Under the direction of A. B. McMullen, director of the aviation division, State Road Dept., the program includes talks on various topics including air tours, schools, fixed base operators, clubs, airlines and airports.

A two-way radio communication demonstration, ground to plane, will be one of the features of the program. In addition, the hourly airway weather report receptions over the Federal radio range network, will also be demonstrated to the visitors.

Pilots from Massachusetts, Connecticut, Idaho, Illinois and Ohio and a number of other states are endeavoring to get organizations formed.

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DIGEST OF THE NEWS

PRIVATE FLYING

Convention

The Fort Wayne Aero Club has invited all clubs within a radius of 150 miles to attend a convention the latter part of September at the Paul Baer Municipal Airport. It is planned to promote friendly feeling among clubs and to stimulate more interest in cross country flying.

Events

A crowd estimated at 100,000 witnessed the second annual Toledo *News Bee* aviation day at Transcontinental Air Port. Acrobatic flying was demonstrated by Lieut. Joe Mackey, Maj. Al Williams, Mike Murphy, Ed Leach and W. Myron Hightower, and Earl Stein made a delayed parachute jump. Others participating in the program included Maj. Fred L. Smith, State Director of Aeronautics, Chet Fenton, manager of the airport, William Robertson, Department of Commerce inspector and others.

* * *

The third annual New Philadelphia (Ohio), Air Day will be held at the municipal airport July 12. Last year more than 30,000 spectators witnessed the event.

* * *

Sixteen planes carrying 49 persons participated in the 1936 Missouri State Air Tour sponsored by the Air Tour Committee of the Lambert-St. Louis Airport Association. Starting from Lambert and terminating at Columbia, the tourists covered 686 miles and stopped at 12 Missouri cities.

* * *

The Texas Eagles Flying Club and the Panhandle Centennial Entertainment Committee sponsored an air show at Pampa, Texas, June 2-3 that was attended by about 6000 persons. Lee Miles flying a 145 hp Warner Cessna, won the largest share of the prize money, taking first in four events. Other pilots participating in the program were Frank Shaw, G. Christopher, L. T. Dutcher, C. Breedlove, A. F. Holt and Ray Shifflett.

* * *

Sixteen planes were enrolled in the Sixth Annual Invitation Seaplane Cruise which started from the Sands Point Bath Club, Port Washington, N. Y., for Chesapeake Bay. Four Fairchilds, three Wacos, two Commuters, Sikorskys and Travel Airs, and a Stinson, Bird and Fleet were used in transporting the 36 cruise members.

* * *

The first spring tour of the Aviation Country Club of Southern California drew more than 60 planes which flew from Grand Central Airport, Los Angeles, to Sonora, Calif.

* * *

The annual Arkansas air tour has been set for July 11-12. At least 30 ships are expected including some from Barksdale Field, Shreveport. The exact route to be followed has not been determined but the tour will be concluded at Pine Bluff where the Arkansas Centennial Air Meet will be held July 12.

* * *

State, county and municipal officials have been invited to the state-wide aviation conference in Orlando, Fla., July 9-10. Problems and progress of aviation will be discussed.

AIRPORTS

Improvements

Birmingham, Ala. New runways, hangar, resodding, repavement, improvements to drainage system, general repairs, $240,000. WPA project.

Bryce Canyon, Utah. New hangar.

Chicago, Ill. Municipal airport; hard-surfacing runways, straightening and widening runways, new taxi strips, $2,134,792.

Columbia, Mo. New building for Department of Commerce radio unit, offices and waiting rooms, $1460.

Fort Wayne, Ind. Paul Baer municipal airport; radio range beacon, boundary lights, NW-SE hard-surfaced runway.

Galesburg, Ill. Grading, new runway.

Grand Island, Neb. Runways, administration building, $68,710. WPA project.

Joplin, Mo. Grading and surfacing four runways and installation of drainage tile, $51,764; grading grounds $6000; lighting equipment, $17,500.

Lima, Ohio. New hangar, expansion of shops, purchase of new plane, $25,000. B. C. Arquitt, lessee.

Minnesota. Air marking 750 towns; Minnesota Aeronautics Commission, Maj. R. S. Miller, chairman; $51,646.

Moline, Ill. Grading, new runway, $372,935.

North Platte, Neb. General work, $1491. WPA project.

Omaha, Neb. Repairs, additions, $262,550. WPA project.

Pittsburgh, Pa. Allegheny County Municipal Airport; lengthening runways, N-S to 2500 ft., NW-SE to 3300 ft., resurfacing entire acreage, fixing parking areas.

Poplar Bluff, Mo. Fencing, runways, drainage, $10,984.

Rockford, Ill. Camp Grant; grading and general work, $27,921.

San Antonio, Tex. Municipal field; administration building, extension and reconstruction of runways, lighting, leveling, grading.

Salt Lake City, Utah. 70 acres added to field.

St. Cloud, Minn. U. S. Weather Bureau station completed; in operation 24 hours daily.

St. Louis, Mo. Lambert-St. Louis Field; blind landing system, $4,384.

Schenectady, N. Y. County Airport; landscaping, grading, seeding, drainage ditches, extension of concrete apron, oiling runways.

Texarkana, Tex. Runway resurfacing, sodding, drainage, clearing obstructions, administration building, lighting installation.

Tulsa, Okla. Municipal Airport; runway extension, NW unit to measure 100 ft. × 3300 ft.; new runway, NE-SW 100 ft. × 3300 ft. Charles Short, Jr., airport manager. WPA project.

Wink, Tex. New hangar.

Winona, Minn. Conrad Airport; administration building. J. A. McKeown, operations manager and chief pilot, Conrad Flying Service.

Ocola, Melbourne, Davis Islands, West Palm Beach, Lake City, DeLand, St. Petersburg, St. Augustine, Kissimmee, Ft. Pierce, Sanford, Florida. Obstruction, boundary and flood lights, $35,000. Maj. A. B. McMullen, Miami.

New Companies

Olympia Flying Service, Inc., Olympia, Wash. J. R. Cram, N. Schaefer, A. G. Schaefer, P. H. Winston, incorporators.

Hamilton Aviation Corp., Hamilton, Ohio. G. E. South, L. M.

(*Continued on following page*)

Views of the Cunningham-Hall GA-36 which features a high-lift wing with a full span automatic slot in the lower side and an aileron in the upper surface

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(*Continued from preceding page*)

South, H. Arnold, incorporators.

Thompson Airways, Inc., Union Trust Bldg., Baltimore, Md. F. C. Wachter, J. C. Murphy, E. C. Backoff, incorporators.

Winnepesaukee Air Servcie, Lake Winnepesaukee, N. H. Seaplane service with Beechcraft, Wacos and Fleet equipment; new bases under construction at Weirs, Alton Bay, Wolfeboro, N. H. T. Rice, pres.-treas.; Capt. R. S. Fogg, operations mgr.; Winsor Harlow, Jack MacManus, Andrew Cannon, pilots.

Gages Flying Service, Gages Airport, Mansfield, Ohio. General repair and service; charter and instruction in Travel Aire, Waco, Commandaire, J-2 Taylor Cub. Glen Gages, Paul Gimbel, Richard Martin, officials.

Expansions

Indiana Air Service, South Bend, has taken over Air Services, Inc., of Akron, O., which is now called the Akron Airways and is managed by C. H. Betz and R. A. Van Devere. All grades of aviation gasoline will be stored. Specialty is made of charter work, sales, service and instruction.

Grand Central Air Terminal

Aircraft Industries' new engine overhaul shops are nearing completion in the old Airplane Development hangar. Shops and stock room will be more than twice the former quarters.

Biederman instrument repair shops are preparing to move to a new shop, in the same building, offering three times the floor space and accommodating new equipment already ordered.

Air Associates moved to the western end of the old TWA hangar with double the floor space formerly occupied.

Approval

Consolidated Aircraft Inc., Fort Wayne, Ind., operated by Ralph Bleke and Edward Notestein, was granted approved repair station certificate 276. The firm is now rebuilding the Bendix Bellanca Skyrocket and Bernard Lloyd's J6-9 Stearman.

Personnel Notes

W. F. Luke, former Mohawk Airways' (Albany) president, is now manager of Schenectady (N. Y.) airport. Ass't. manager George C. Haven operates Taylor Cub, Lambert Monocoupe, Waco F and Waco Cabin planes under exclusive flying rights there.

* * *

Tom Newhouse and Chet Fess, Chambers (Neb.) businessmen, built an airport there from which to fly their new planes.

* * *

Aeronautics Committee Secretary Charles Doyle of Nebraska is attempting to obtain airport facilities for his southeast district. Falls City and Broken Bow are possible sites.

* * *

Dispatcher A. W. League is the new assistant to Ralph Page, Airport Manager of Lambert-St. Louis Field.

* * *

Stinson's southwest distributor Aircraft Industries, Inc., at Glendale's (Calif.) Grand Central Air Terminal added veteran pilot Tex Rankin to its sales staff.

SCHOOLS

Personnel Changes

Jack Luther has joined the Engineering School's faculty at the Curtiss-Wright Technical Institute of Aeronautics as assistant instructor in mathematics.

* * *

Glen Binkley has been added to the Grand Central Flying School mechanic's staff for line maintenance, as assistant to Arky Huggler.

Students of Roosevelt Aviation School inspecting undercarriage of Douglas DST upon its initial arrival in the east

Activities

Somerset Flying Club activities are being supervised by Standard Flying Service, Inc., operators of Somerset Hills Airport at Basking Ridge, N. J. George A. Viehmann, president and manager, announced the former club plane will be used for student training and rental. Two new courses, a solo, and an amateur are offered. Ten new students enrolled during the first three weeks of June.

Broadcasts

Rising Sun Aircraft School, Philadelphia, is conducting a series of radio broadcasts each Saturday at 5:15 P.M. (D.S.T.). Through the cooperation of manufacturers of aircraft engines, airplanes and accessories, interesting news will be broadcast along with data on the aviation industry in general each week. Arrangements have been made for interviews with prominent citizens on the various phases of aviation in which they are connected.

Award

The Dr. S. A. Reed Memorial Prize for graduate research in aircraft propellers was presented to B. G. Bromberg of the Guggenheim School of Aeronautics, New York University. The prize was established this year by Maj. Latham G. Reed in memory of his brother, Dr. Sylvanus Albert Reed, propeller expert.

Activities

The Dawn Patrol of Spartan School of Aeronautics, Tulsa, took part in the Oklahoma State Air Tour by sending seven ships and eighteen students on the first two days of the tour. Their formation visited Claremore, Bartelsville, Miami and Blackwell, giving an exhibition of maneuvers and cross-country flying. Recent enrollments include ten students for special and regular Transport Courses, and five for the Limited Commercial Courses, the largest number of advanced flight students since 1929.

AIR SERVICES

Bombers Near Test

With assemblies well under way, Boeing Aircraft Co. announced that first of its four-engined Model 299 bombers for the U. S. Army Air Corps should be ready for flight during August. Thirteen of these bombers are in production, with four fuselages undergoing assembly at one time. Plans call for completion of approximately one ship a month at the start and two a month about midway through the order. Air Corps officers will flight test and deliver the 299's, which rank as America's largest landplanes and as the fastest and longest range bombers ever built.

308 New Planes

Strengthening of the U. S. Army and Navy air forces by 308 new planes was assured when War and Navy Departments awarded contracts for that number of ships to four corporations.

Navy awards go to Northrop Corp. for 54 type VB dive bombers, Chance Vought for 54 planes of the same type and to Curtiss Aeroplane & Motor for 83 type VSB scout-bombers, and 40 type SBU scout-observation planes.

Army award goes to Seversky Aircraft Corp. for 77 P. & W. powered pursuit planes and parts equivalent to 8 planes to cost $1,636,250. Ships are low-wing, all-metal cantilever monoplanes with retracting gears. Cockpits are enclosed in transparent sheet sliding enclosures; flaps and controllable-pitch propellers are provided, and construction follows monocoque design.

Cost of the Navy planes was not disclosed, marking a deviation from former procedure of the Department. Cost, however, of the Curtiss scout-observations is $759,630 making income to that company from the Navy for this type in the past year $3,512,335. Previously 135 SBU planes were ordered.

Navy planes will be powered by Pratt & Whitney Twin Wasp Juniors equipped with Hamilton Standard constant speed propellers, while Army pursuits will have 1000 hp (take-off) Twin Wasps of the type described in the May 1936 issue of AERO DIGEST. Hamilton-Standard constant speed propellers will also be used in the Army planes.

March Field Airplanes

Six new airplanes will be added to the complement of the 19th Bombardment Group at March Field, Calif., in August, according to Brig.-Gen. Henry B. Clagett, commanding the First Wing, G. H. Q. Air Force.

First group of the planes scheduled for delivery will be five Martin B-10B Bombers. These will reinforce the 19th Bombardment Group to a strength of 14 Martins. With the exception of minor improvements, the new planes are much the same as the present nine in service there.

The other plane expected in August is one of the new DC-34 Douglas Transports. It will be slightly larger than the flagship of the GHQ Air Force, based at Langley Field, Va. Designed principally to haul freight, it will have a track running down its center to facilitate handling material. Seats may be placed in it, however, to carry personnel.

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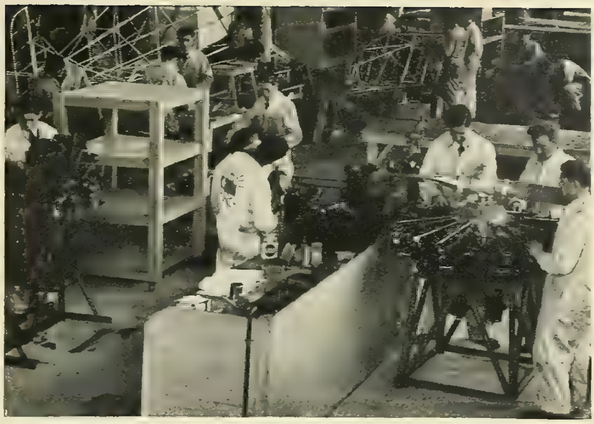

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A. D. July, 1936

AIRLINES

71,449 Passengers

Twenty scheduled airlines carried 71,449 passengers, flew 4,844,556 miles and 30,326,036 passenger miles in April 1936, according to the Bureau of Air Commerce. Comparisons show about 10,000 more passengers than April 1935, and more than any previous month this year. Miles flown increased to its greatest height this year, but express poundage, passenger miles, and percentage of seat capacity used were down over March 1936, though well ahead of April 1935.

* * *

Volume of air mail transported in March 1936, set a new record of 1,396,977 pounds, exceeding by 79,203 lbs. the previous high in December 1935. March, 1936 volume was approximately 400,000 pounds more than that for the same month in 1935 and nearly twice that transported during any previous March in the history of the air mail service. A total of 13,268,730 pounds of air mail was flown during 1935, almost doubling the poundage transported during the three preceding years.

* * *

Air express revenue for April 1936, showed an 85% gain over that for April of last year, according to the Air Express Division of Railway Express Agency. February 1936, the first month of co-ordinated air express service, showed a 63% increase over the combined express revenue of the contract air lines for February 1935, and March registered a still greater gain, 75%, above March of last year.

* * *

Completing all but 0.15% of its scheduled mileage in May, Central Airlines, operators of the Washington-Detroit airway, carried 2,406 passengers, an all-time high for passenger traffic for that company.

* * *

During May, Transcontinental & Western Air, Inc., filled 74.09% of available passenger space on its Douglas transports—the highest it ever recorded. For the same month, performance efficiency was 99.75%. May records show an increase of 901,849 seat miles operated, with a total of 9,724,333; and an increase of 1,785,945 seat miles occupied with a total of 7,205,083.

* * *

Introduction of new Lockheed Electra transport service, brought a 173% increase in passenger traffic on Chicago & Southern Air lines route during the first half of May compared with the same period of 1935.

Wasp-Jr. powered Spartan all-metal Executive model now being test flown

Express Only

Jack Frye, TWA president, reports studies of possibility of developing an "air express only" type of service using special air express planes.

Successive months have continued to show an increase in poundage carried by General Air Express, the TWA independent system, until the assignment of special equipment to the task of carrying express loads now is receiving consideration. Company officials have been running a series of flight tests and conducting surveys on the *flying express car* service to determine costs and operating conditions, using one of the Douglas transports converted into an express only special. Possibility of using high-speed single-engined equipment also is being studied with the Consolidated *Fleetster* a possibility.

Schedules

Transcontinental & Western Air, Inc., increased service between Los Angeles and New York with the addition of a new round-trip Sky Chief schedule. The flight leaves TWA's new headquarters, Union Air Terminal, Burbank, at 2 p.m. and arrives at Newark at 8:30 a.m. the next morning. Elapsed time, 13 hrs. 30 min.

* * *

A fifth daily round trip between Detroit and Washington was added by Pennsylvania Airlines, bringing the line's monthly scheduled flying to approximately 165,000 miles. The new service enables connections with United Air Lines at Cleveland for Chicago, California and Seattle, and with TWA at Pittsburgh for midwest and west coast points.

* * *

Resumption of daily passenger, mail and express service operated by Boston-Maine—Central Vermont Airways to and from Bar Harbor, Me., became effective June 26.

Vacation Tours

United Air Lines is offering airplane service from either seaboard and intermediate points to Yellowstone Park in cooperation with National Parks Airways and a special 150-mile flight directly over the park. This side tour is made during a seven-hour stopover at Salt Lake City.

Another tour offered is over Boulder Dam-Grand Canyon. Flights over the Grand Canyon are made via Grand Canyon Airlines. These trips, ranging from seven hours to a full day, start from Las Vegas, Nev. Airport.

100 Million Miles

On June 17, United Air Lines completed 100 million miles of flying in more than ten years of operation, becoming the first airline in the world to reach that goal of flying experience. The mileage was recorded over the New York-Chicago-California route, and the Seattle-San Diego line. United has carried 775,000 passengers, 17,000 tons of mail and 4,651,000 pounds of express in flying this number of miles.

Fare Increase

Chicago & Southern Airlines increased passenger fares from less than 4¢ a mile to slightly more than 5¢ to adjust rates to the approximate level of other airlines operating bimotored equipment.

Coming Events

Seventh Annual Soaring Contest, auspices Soaring Society of America, Elmira, N. Y. June 20-July 5

●

Denver Mile High Air Races and 1936 National Balloon Races, Denver Municipal Airport, Denver, Colo. July 3-5

●

Florida Aviation Conference, Orlando, Fla.; Maj. A. B. McMullen, Director of Aviation. July 9-10.

●

Kings Cup Race, England. July 10-11

●

New Philadelphia, Ohio Air Day. July 12

●

Annual Arkansas Air Tour and Arkansas Centennial Air Meet, Pine Bluff. July 11-12

●

1936 Wolverine Air Cruise, from Detroit, Mich., auspices Sportsman Pilot's Association. July 18-28

●

Coupe Armand Esders Speed Race, Deauville-Cannes, France. July 25

●

Aviation display and aerobatic competition in conjunction with Olympic Games, Templehoff Airport, Berlin, Germany. July 31

●

International gliding demonstration in conjunction with Olympic Games. Templehoff Airport and on the Wasserkuppe. August 4

●

Dominion finals, John C. Webster Memorial Competition, Kingston, Canada. August 23-24

●

1936 National Air Races, Los Angeles, Calif. Sept. 4-7

●

Deutsche de la Meurthe Cup Race, auspices Aero Club of France, Étampes Montdesir Airport. Sept. 13.

●

National Aircraft Production Meeting, SAE, Los Angeles, Calif. Oct. 15-17

●

Paris-Saigon round-trip speed race, sponsored by Aero Club of France. October 25

●

International Aviation Show, Grand Palais, Paris, France. November 13-29

●

National Aircraft Show, auspices Aviator's Post 743, American Legion, Grand Central Palace, New York, N. Y. Jan. 28-Feb. 6, 1937

THE INDUSTRY

456 Planes

Aircraft production in the United States for the first quarter of 1936 increased 33⅓% over that for the same period in 1935, continuing the upward trend which commenced in 1934. Total of all aircraft manufactured in the United States during this period was 456, while that for the same period last year was 349.

Most noticeable increase was a 28% rise in the manufacture of light airplanes. The major increase in this classification occurred in the number of two-place cabin land monoplanes; 45 were manufactured during January-March 1935 and 100 in January-March 1936.

Of the total aircraft produced, 216 were for domestic civil use, 173 for military delivery and 67 were exported. The industry manufactured 190 monoplanes and 26 biplanes for domestic civil use. The 190 monoplanes included 15 of the open cockpit type and 175 cabin craft. Of the biplanes 2 were open cockpit and 24 were cabin planes.

There were 36 companies or individuals producing airplanes for domestic civil use during the first quarter of 1936, and of these, 8 manufactured approximately 74% of the total airplanes designed for civil use.

Business Reports

Irving Air Chute Co., declared its regular quarterly dividend of 25 cents a share, payable July 1 to stockholders of record June 18.

* * *

Unfilled orders on hand June 1 at Lockheed Aircraft Corp. totalled 11 twin-engined transports valued at approximately $630,000, exceeding by almost $200,000 backlog of orders a year ago.

* * *

Plant of Fleet Aircraft Co., Ltd., started construction of 16 airplanes for the Mexican government. Although details of the

(*Continued on following page*)

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FAIRCHILD 24
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Artist's drawing of new propeller plant in Hartford

(*Continued from preceding page*)

contract are not known, it is understood the planes will be of the amphibion type. Capt. H. S. Calvo, attaché of the Mexican War Department, is supervising construction. Fleet Aircraft, a subsidiary of Consolidated Aircraft Corp., doubled the size of its factory recently.

* * *

Record total of orders on hand is announced by Menasco Manufacturing Co., with unfilled orders exceeding in dollar volume the entire total of 1935 business for the fiscal year ending June 30, 1935.

* * *

Sale of 15 airplanes, representing a gross value in excess of $26,000 during the first quarter of 1936 was reported by W. W. Kratz, president of St. Louis Flying Service, Inc., Lambert Airport. Gross returns approximately doubles volume of business as closed for the same period last year. Net sales return of $100,000 for 1935 was previously reported and in anticipation of business increase as experienced thus far this year, additional hangar space was taken.

New Factories

Immediate construction of a new factory for Hamilton Standard Propellers division of United Aircraft Manufacturing Corp., was announced by Raycroft Walsh, general manager.

The new unit will be adjacent to the south side of the Pratt & Whitney factory in E. Hartford, Conn., and will be a monitor-roofed one-story brick structure, approximately 400 ft. long by 250 ft. wide and containing more than 100,000 sq. ft. of manufacturing floor space. Additional 10,000 sq. ft. of factory office space will be on a mezzanine floor. Requirements for increased administrative office space will be met simultaneously by addition of a third story to the present United Aircraft administration building.

Column spacing has been increased from 32 × 40 ft. in present buildings to 64 × 64 ft., providing 4096 sq. ft. of unobstructed area between columns. This, combined with a modern system of power distribution through overhead bus bars, permits maximum economy and flexibility in the placing of machinery. Lighting will be by high intensity mercury vapor lamps, eliminating need for individual lamps at each machine. Propeller machinery now in the Pratt & Whitney Aircraft factory will be transferred to the new building and a considerable quantity of new machinery is also being acquired. It is expected that the factory will be ready for occupancy early in September. Albert Kahn, Inc., designer of all United Aircraft factories in East Hartford, is the architect, and the general contractor is R. G. Bent Co., of Hartford, builders of the Chance Vought factory.

* * *

Lockheed Aircraft Corp. has taken option on acreage near Union Air Terminal, Burbank, Calif., and plans the construction of a new factory. Construction of buildings with floor space of from 100,000 to 125,000 sq. ft. is contemplated.

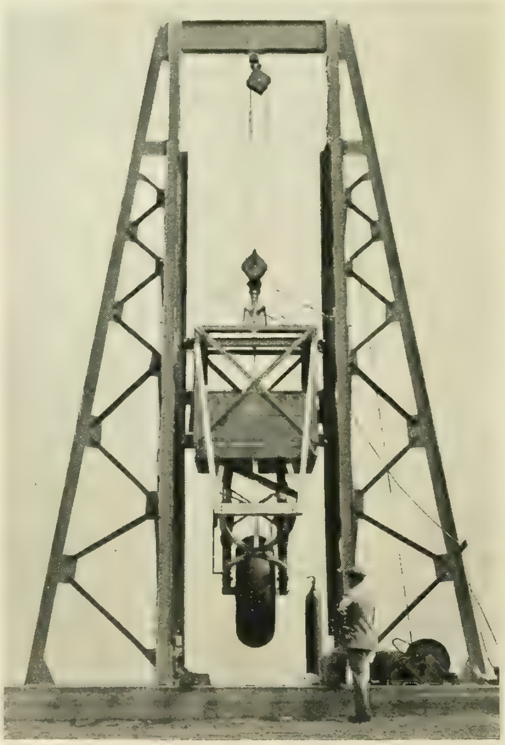
* * *

Increased production necessitated removal of Aeromarine Instrument Co., Inc. to larger quarters at 450 Whitlock Ave., New York. Aeromarine manufactures a complete line of aircraft instruments for use in sport and commercial craft.

Drop Test Jig

One of the largest drop test jigs ever built is used by Boeing Aircraft Co. to determine load factors of the landing gear being installed on the Model 299 bombers for the U. S. Army Air Corps.

Boeing drop test jig for landing gear load factors



The jig is of structural steel, on a cement foundation, and is 30 ft. high. Loads are placed on a moving carriage which is guided by ball bearings fitted around a track running the vertical length.

Tests of a Boeing 299 main wheel assembly reveal that the gear will withstand a load of approximately 80 tons as compared to the bomber's gross weight of 16 tons. In these experiments, a load of 16,000 lbs. of lead was placed on the carriage of the jig and dropped 24 in. to produce an impact on the one wheel of approximately 40 tons. The object not only was to determine loads but to test the shock absorbing struts for their ability to absorb loads smoothly and evenly.

Main tires for the bombers, manufactured by the Goodyear Tire and Rubber Co., measure 55 in. in overall diameter, with a 19-in. cross section and 23-in. rim diameter.

Production Meeting

A committee with several subcommittees has been formed to prepare for the National Aircraft Production Meeting of the SAE to be held October 15-17 inclusive in the Ambassador Hotel, Los Angeles.

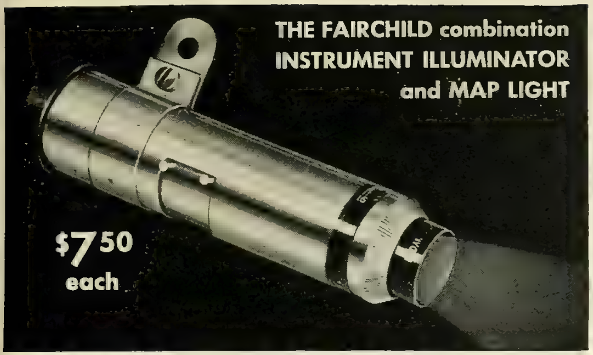
C. E. Stryker, chief engineer, Curtiss-Wright Technical Institute of Aeronautics has been appointed general chairman; Hall Hibbard, Lockheed Aircraft, heads the papers committee; Dr. A. L. Klein, California Institute of Technology, inspection trip; Bill Gwinn, Pratt and Whitney, banquet committee; William B. Stout, consulting engineer, toastmaster.

Award

Donald W. Douglas, president of Douglas Aircraft Corp., has won the 1935 Robert J. Collier Trophy for the design and construction of the 14-passenger, twin-engined Douglas DC-2 transport.

Collier Trophy has been awarded annually for "greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by actual use during preceding year."

(Continued on following page)



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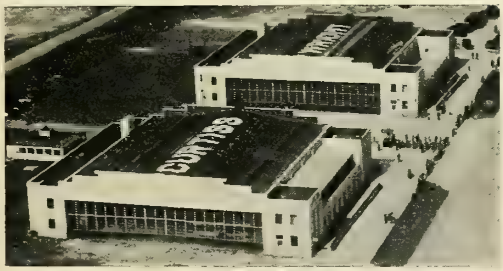

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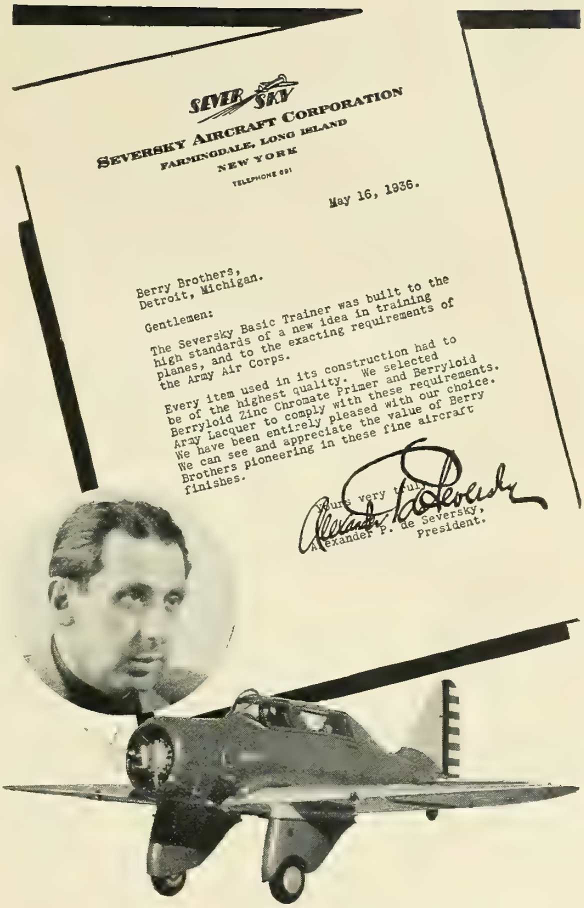

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(Continued from preceding page)

Approvals

Approved type certificates have been issued by the Department of Commerce to the following:

Hammond Aircraft Co., Ypsilanti, Mich.; model Y-1 M125-A, 2-place cabin monoplane; 125 hp Menasco Pirate C4 engine (ATC No. 599).

Fairchild Aircraft Corp., Hagerstown, Md.; model 24-C8E, 3-place cabin monoplane; 145 hp Warner Super Scarab Series 50 (ATC 600): model F-45, 5-place cabin monoplane; 320 hp Wright Whirlwind R760E-2 (ATC No. 603).

Arrow Aircraft & Motors Corp., Lincoln, Neb.; model F, 2-place open monoplane; 82 hp Ford V-8 (converted) engine (ATC No. 601).

Beech Aircraft Corp. Wichita, Kans.; models C17L, SC17L, C17B, 4-5-place cabin land or sea biplane; 225 hp Jacobs L4 (models C17L and SC17L); model C17B, 285 hp Jacobs L-5 (ATC No. 602).

* * *

Rearwin Sportster, powered with an 85 hp LeBlond has been licensed as a seaplane by the Department of Commerce. The ship, a standard Sportster with interchangeable float and wheel landing gear fittings, was installed on Edo model 1525 floats. It is licensed for pilot and passenger, together with 24 gal. of fuel and an allowance of 64 lbs. for baggage and equipment. Licensed gross weight is 1615 lbs., which, with a standard weight empty of 1052 lbs. leaves a useful load of 563 lbs.

Future Sportsters will be equipped with seaplane fittings, thus making them eligible for a seaplane license when equipped with standard Edo 1525 float gear.

Personnel Changes

W. T. Piper, Jr., is now assistant superintendent of Taylor Aircraft Co., Inc.

* * *

New president of Fairchild Aircraft is Col. John H. Jouett, former technical aviation advisor for Standard Oil Company of N. J.

* * *

H. C. McElhone, who has served in the works, headquarters sales, stock control and executive departments, has been appointed assistant to vice-president of the Westinghouse Electric and Manufacturing Co.

* * *

Former Bellanca Chief Engineed N. F. Vanderlipp is now general manager of Fairchild Aircraft, Ltd. engineering and manufacturing activities at the Longueuil plant.

* * *

Ollie Davis, formerly with Jacobs Aircraft Engine and Waco Sales of New York, is the new eastern factory representative for Beech Aircraft Co.

* * *

Ex-Cell-O Aircraft & Tool Corp. appointed A. D. Heath its sales representative in Southern Indiana to handle all its products in this territory, including those of the Continental and Machinery Divisions.

* * *

W. C. Clayton joined the Aeronautical Chamber of Commerce as aeronautical engineer. He will work under the direction of the Engineering Committee of the Chamber on special surveys seeking improvement in requirements for the design and construction of airplanes, and will coordinate engineering thoughts of the industry for presentation to the Bureau of Air Commerce which specifies the airworthiness requirements for all aircraft subject to federal regulations.

Equipment

With completion of a 22,000-lb. drop hammer in the Ryan Aeronautical Co. factory parts production for the Ryan S-T has been speeded up. Installation of the new machine was under the direction of Fred Rohr, factory superintendent. Ryan also placed orders recently for additional molding and modeling equipment, heat treat baths and melting pot furnaces, which will be installed shortly.

85 hp LeBlond-powered Rearwin Sportster seaplane

Japanese Licensee

Beech Aircraft Co. contracted with Japan Air Transport, Tokyo, giving them exclusive right to manufacture Beechcrafts in Japan.

The Japanese company, which will build a new factory in which to make the Beechcrafts, flies under an exclusive government charter. It conducts charter work and operates a passenger, mail and express service for which it will use the Beechcrafts for feeder-line operations.

One C17E Beechcraft has been purchased for delivery in Yokahama.

Credit Company

Articles pertaining to the establishment of The Aviation Credit Corporation of St. Louis, are now being filed according to W. W. Kratz, vice-president and general manager of the new organization which will have headquarters on Lambert-St. Louis Airport.

Under present plans money will be available to individuals and dealers for the purpose of financing sales of both new and used airplanes, general aircraft remodeling involving engine repair, airplane parts replacement, the purchase of instruments, etc.

The corporation is under operation of W. R. Shillington, president; Dumont Dempsey, treasurer; and Lazear Baker, secretary.

Sales

Four Menasco-powered AG7D Crusaders to Mountain Airways Corp., with option on fifth for airline service in Wyoming, Montana, Colorado, Utah.

* * *

Six tri-motored Stinson Airliners to private individuals by St. Louis Flying Service, Lambert-St. Louis Field. Purchasers are K. M. Oliver, Loretta, Kans.; Capt. L. I. Avatz and M. Murphy, Lafayette, Ind.; W. Harvard, Pittsburgh; H. McClintock, Pittsburgh; Monarch Air Service, Chicago.

* * *

Fairchild 24 to Betterton, Parham & Handley Flying Club Chattanooga.

Waco J-5 to W. W. Wycoff, St. Louis.

* * *

Four hundred Continental A40-3 engines to Taylor Aircraft Co., Inc., Bradford, Pa.

* * *

Aeronca to Ralph Kirby, NBC radio artist, by Standard Aviation Service, Teterboro, N. J.

* * *

Rearwin Speedster to J. V. Salvador, Peoria, Ill., by Airplane Sales Corp., Robertson, Mo.

* * *

Fairchild 24, 145 hp Warner Super Scarab to George Arents III by Fairchild Sales, Roosevelt Field, Garden City, N. Y.

* * *

C17B Beechcrafts to C. J. Strickland, Newark Air Service; Howard H. Batt, Santa Monica; Beech-Air Sales of New York; Charter Service, Oklahoma City.

New Dealers

Brown-Ernst Co., Mines Field, Inglewood, Calif., for Ryan S-T.

* * *

Midwest Airways, Milwaukee County Airport, for Rearwin airplanes in Wisconsin.

Digest of Recent Events

TWA Douglas Lowers Chicago-New York Time

Officials of Transcontinental and Western Air, Inc., announced that for the fourth time in eight days the TWA *Sky Chief* had established a new speed record between New York and Chicago. Claiming a new record for transport planes, officials said that the ship averaged 192.4 mph to fly the 731 miles in 3 hours 48 minutes, fifty-seven minutes ahead of schedule.

The *Sky Chief*, piloted by Hal Snead, landed at the municipal airport 4 hours 3 minutes after the take-off. Another record was established June 5, when the plane covered the distance in 4 hours 11 minutes; flying time claimed on June 8 was 4 hours 6 minutes. On its fourth run the *Sky Pilot* was flown by Pilot Andrews. JUNE 13

DST Makes Flight Across Continent

First showing of the new twin Wright Cyclone engined Douglas DST in the east was at Roosevelt Field where the newest American Airline transport landed to help celebrate the dedication of an automobile race track on old Field No. 1. In a test flight a few days later, the plane flew non-stop from Chicago to Newark and return in 8 hours 5 minutes on 52% of available power. Flying at 12,000 ft. on the first leg of the hop, the DST covered the distance in 3 hours 33 minutes. At 8000 ft., the return was made in 4 hours 32 minutes. Pilots Sloniger and Pricer were at the controls of the plane which carried 10 passengers and 3 crew. JUNE 13

"Hindenburg" Sets New Trans-Atlantic Record

Westward time across the Atlantic Ocean by lighter-than-air craft was reduced by the *Hindenburg* on her third crossing to the United States when she flew from Frankfort to Lakehurst in 59 hours 50 minutes. Time was 1 hour 48 minutes better than before, with an average speed of 60.53 knots for the 3910 miles. Dr. Hugo Eckener commanded the flight which was made by 44 passengers and a crew of 54. Mail carried totaled 330 lbs., while express was 170. JUNE 22

THE PIERCE CHRONOGRAPH, NEW 4-IN-1 WATCH

(Tachometer • Stop Watch • Telemeter • Wrist Watch)

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The PIERCE CHRONOGRAPH serves a four-fold purpose in aviation: As a *Tachometer,* to check m.p.h. As a *Stop Watch,* to time (in seconds and fifth-seconds) air races; also to clock new equipment over a measured speed course. As a *Telemeter* for pilots, co-pilots and navigators—in storm areas—to determine the distance of light and sound. As a *Timepiece* to check schedules, and for all around use.

Many pilots are using the PIERCE CHRONOGRAPH for such diversified purposes as checking take-off and landing time, with and without loads; checking rate of climb against altimeter; timing turns in instrument flying; checking timed flights under adverse weather conditions; checking fuel consumption, etc. The PIERCE CHRONOGRAPH has a seven jewel movement fully guaranteed against mechanical defects; case has steel back. Pocket models also available.

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FOREIGN NEWS IN BRIEF

Australasia

Qantas Empire Airways increased the weekly service from Brisbane to Singapore to twice weekly. The fleet of DH 86's has not been augmented but existing machines will be called upon to fly nearly a million miles a year. Additional pilots have been engaged. The duplicated service also marked a general reduction in passenger and express charges. The through fare from Brisbane to London is now £200 and local intermediate fares show proportional cuts.

Civil Aviation Boards, the recently constituted authority to control civil aviation in Australia, has decreed that commercial pilots must pass blind and instrument flying tests. Regulations will also be promulgated prohibiting flying by inexperienced pilots on difficult routes. Compulsory installation of radio on all passenger planes is contemplated.

Stinson Airliner, first of three to be imported by Airlines of Australia, inaugurated twice daily service between Sydney and Brisbane by setting a commercial record for the route, covering the 510 miles in 2 hours 45 minutes. H. D. Boyer of American Airlines was at the controls.

Within a week of its delivery the Douglas DC 2 delivered to Holyman Airways flew the Melbourne-Sydney service in charge of Major Bertrandias, and made a commercial record of 2 hours 15 minutes. After three days on this run, the Douglas was transferred to the Melbourne-Hobart route where it will continue for the present.

Two Stinson Reliants have arrived for private owners, two more for use by Guinea Airways in Papua and New Guinea, and a Waco has been ordered for import in Australia. Only British development was aquisition of two DH 89 A's by Adelaide Airways for use on the Melbourne-Adelaide service, now increased to thrice-weekly in each direction.

Bids have closed for lighting equipment of the Brisbane-Sydney route and terminal airports at Mascot and Archerfield. Seven beacons will be provided, self-generating and automatic in operation. The route will be equipped for night flying by October this year when bids will be called for the Sydney-Melbourne-Hobart route.

Federal Government has called for bids for lighting equipment at all principal airports along intercapital air routes. Work is to commence immediately upon acceptance of the bid.

Grafton Aerodrome (N.S.W.) has been licensed by the Aviation Department following completion of improvements, and Airlines of Australia has made it a flag stop on the Brisbane-Sydney run.

Colonial Government is considering inauguration of air services in Portuguese East Africa between Lourenco Marques and Johannesburg, and between northern and southern borders of the Colony.

Holymans Airways Pty. Ltd., has appointed two hostesses to be employed on its Douglas which shortly will arrive in Australia. The hostesses are the first so employed in Australia.

Canada

Canada is preparing for operation of trans-Atlantic air service. Meteorologists left Toronto, headquarters of the Dominion meteorological service, early last month for the Newfoundland base of the service.

In other fields activity on the service is shown by the announcement of Defence Minister Ian Mackenzie, that Imperial Airways is about ready to start experiments, that ground preparations have been completed, and that by the beginning of 1938 a regular service will be in operation. By that time also he stated the trans-Canada airway should be working.

Meanwhile the Canadian government is debating whether private or public planes will fly the mail across the Dominion in an 18-hour or better service from Halifax to Vancouver. It will take six months for the organization that receives the contract to get the system functioning smoothly, before mail can be carried, Parliament was told. It is considered likely that larger operators will get the mail contract on a mileage basis, while the government will operate the ground, radio, and weather services.

London Flying Club has received another plane from the Canadian government, as part of the policy of supplying clubs with training ships every other year. The new Fleet is equipped with blind flying instruments.

Another mail route was opened last month in the northern Ontario mining region north of Minnesota. The new route is an addition to the routes out of Kenora, and touches at Cole, Golden Arm, and Red Lake, servicing mines in a new territory.

Construction of intermediate airports and landing fields, hangars, and other facilities on the trans-Canada airway progressed favorably in 1935. Construction was carried on at 48 locations. Twenty are usable although not complete and 9 others might be used in emergency. Fireproof hangars were erected at Wagaming, Kapuskasing, Emsdale, and Gegantic. Development work was completed at 10 airports and landing fields; 34 intermediate airports and landing fields were under construction during the year, sites acquired but not being developed number 10 while the number of intermediate landing places completed prior to 1930 number 30. Municipal and public airports forming part of the airway number 20.

The summer flying season has been officially opened by members of the Montreal Light Aeroplane Club at their Cartierville Airport headquarters. A lengthy program of activities has been prepared, and plans are under way for the reception of 75 planes taking part in the 1936 Roosevelt Field Good-Will flight.

A feature of this year's training will be a course in blind flying. The clubhouse has been refurnished and the planes have been overhauled and put in first-class condition.

Philip C. Garratt has been appointed managing director of the de Havilland Aircraft Company of Canada, as successor to Lee Murray, who has returned to the parent company in England. Garratt is the first Canadian to fill this post, indicating perhaps a change in the policy of the parent company toward complete native management for its Canadian branch.

Czechoslovakia

American equipment is flown between London and Budapest via Amsterdam, Rotterdam, Essen, Leipzig, Prague and Vienna on the newly opened service operated by Czechoslovak Air Transportation Co. in cooperation with K. L. M.

France

After successful flights with a Sikorsky S-38, Aeromaritime Co. is awaiting three S-43 Amphibions to start commercial operation of a line between Dakar and Pointe Noire.

Society Marcel Bloch purchased a large field near Chateauraux where it will build a new factory and a private airport. Move was made to meet Air Ministry's desires to decentralize the French aeronautical industry.

The Annual Air Display for 1936 will take place on July 12, at Le Bourget.

(Continued on following page)

Squadrons of Italian bombers lined up at a flying field in Ethiopia. These are single and multi-engined Capronis

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the fabric that had been conforming to these new standards since it was first produced, nearly three years ago.

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We specialize in cords and wire for Aircraft and Airport Telephone and Radio Equipment. Our cords are standard equipment in many of the large airlines.

For prices and samples send us your specifications.

(*Continued from preceding page*)

Great Britain

Statistics of Britain's overseas trade in aircraft material, released by the Air Ministry, show that from 1924 to 35 the nation's aircraft export business was worth £19,796,181. Complete aircraft sent abroad numbered 3,415, worth in the aggregate £7,091,969; engines numbered 6,204, worth £5,589,631; and the value of spare parts exported was £7,114,581.

In 1935 British exports reached a new record of £2,721,441, exceeding 1934 by £800,000 and far above the previous best year's trade—recorded in 1929—of £2,158,667. Figured on the basis of $5 for the English pound, British exports in 1935 were valued at $13,607,205 compared with $14,477,429 for American exports.

Capital of the Hawker Siddeley Aircraft Co., has been increased from £2 million to £4 million to meet exigencies of the production program demanded by the Royal Air Force expansion plan. Largest group in the British aircraft industry, Hawker-Siddeley controls five companies manufacturing aircraft and engines—Hawker, Gloster, Avro, Armstrong Whitworth and Armstrong Siddeley.

Representatives of the Indian government and of Imperial Airways inspected five sites for flying boat landing places on the Empire air route between Karachi and Calcutta. These points, if finally chosen, will serve the fleet of four-engined monoplane boats now being built by Short Bros. at Rochester, Kent.

Empire Air Day, celebrated at civil and military airports all over Great Britain, set new records. Total attendance of visitors was approximately 200,000, as against 140,000 last year. This is the third successive year in which this day has been celebrated, and programs arranged by the various squadrons included many novelties. R.A.F. officers and men entered devised flying and other exhibitions which were vastly appreciated. Dive-bombing, aerobatics, individual and formation flights, squadron drill, air raids, Army cooperation work, radio telephony, parachuting, and flight instruction were included.

Planes of Imperial Airways (including operations over the Karachi-Singapore section which is operated jointly by the company and an Indian subsidiary) flew 290,853 miles in January, 1936, compared with 264,260 miles in January, 1935; for the 10 months ending with January, 1936, mileage amounted to 3,677,341 compared with 2,247,564 miles in the like previous period. The ton-mileage for January, 1936, was 316,631, compared with 294,768 in January, 1935; the ton-mileage for the 10-month period ending with January, 1936, was 4,127,166 and for the earlier similar period it was 2,844,822.

Tests of the Mayo composite aircraft will begin with independent flights by the upper component which is a float-equipped four engined high wing monoplane. Both planes are now under construction by Short Bros.

Japan

Kawanishi Aeronautic Engineering School, first of its kind in Japan, has been established by Kawanishi Airplane Works at Naruo, near Osaka. More than 300 students have already been enrolled, to take the five-year course in aeronautical engineering.

War Office will, during the coming fiscal year (1937-8), embark on an enlistment and training program to train more pilots for the air corps. In all 160 new cadets will be enlisted.

Wright-powered Bellanca Pacemaker operating from Oslo

Mexico

Twelve army planes are being reconstructed in the government's aircraft factories, Mexico City.

Semi-weekly passenger, mail and express service has been started between Mexico City and Morelia, capital of Michoacan. Time between terminals, including stops, is 3 hours 47 minutes.

Application for a concession to operate passenger, mail and express service between Mexico City and Vera Cruz City, Jalapa and the Tuxtlas region, Vera Cruz state, has been made to the Ministry of Communications and Public Works by John Kelly.

Passenger service has been established between Oaxaca City, capital of Oaxaca state, and Tlaxiaco by Compañia Taxi-Aereos de Oaxaca, S.A. This company is conducting Sunday round-trip excursions between Mexico City and various archaeological zones in Oaxaca.

Mexican civilian and military pilots have organized the Society of Pilot Aviators, whose aim is to stimulate aviation in Mexico. Officers are: Manuel R. Varela, president; Raul Esponda B., secretary; and Dr. A. Riveroll, treas.

During 1935, 458 licenses were granted to pilots of which 325 were cancelled for various reasons, leaving 133 in effect on Jan. 1, 1936, of which 57 are for unlimited transport rights, 42 held by Mexicans and 15 by foreigners; temporary transport, six; limited transport, 26; and tourist, forty-four.

Norway

To facilitate access to Winter sport centers in the Norwegian Highlands, Wideröe's Flyveselskap a/s of Oslo is operating a daily service. The aircraft employed is a Bellanca Pacemaker mounted on skis and equipped with a Wright engine and two-way Western Electric radio.

Spain

Contract has been let for the construction of 100 training planes at a total cost of $261,250. Work will be done by Industrias Aeronauticas, S. A. Carabanchel, near Madrid.

Service between Paris, Bordeaux, and Madrid, operated by Air France and the Spanish L.A.P.E. on a cooperative basis, is now flown daily except Sunday, instead of weekly. Air France employs twin-engined Potez-62 planes and the Spanish company Douglas equipment.

Daily service between Madrid and Berlin via Barcelona, Marseille, Geneva, and Stuttgart is now operated by Deutsche Luft Hansa, but Lineas Aereas Postales Espanolas will fly the route at least 1 day a week. Passenger fare for the 1398-miles is $35.

Latin America

A vessel designed and built especially for ocean air mail operations has been launched and will be anchored in the south Atlantic to serve the German air service between Europe, Africa and South America. The new vessel, known as *Ostmark*, is of 2,000 tons displacement and measures 243 ft. in length compared with 5,000 tons each for the *Westfalen* and *Schwabenland* and lengths of 410 and 492 ft. respectively. The older vessels were converted for the purpose, and the *Schwabenland* will be replaced by the *Ostmark* which has a Heinkel catapult forward and a large crane at the stern. It is equipped with two 900 hp Diesel engines and cruises at 15 knots.

Tri-American Aviation, Inc., has completed negotiations for the sale of more than $1,250,000 worth of American aircraft in South America, according to John Montgomery, the company's representative there. This business, Montgomery reports, was consummated during the past year.

Serving more than sixty towns and cities with regular service and about thirty with flag stop service, Transportes Aereos Centro-Americanos, Ltd., of Tegucigalpa, Honduras, is making Central America one of the most air-minded localities in the world. Known as TACA, and headed by Lowell Yerex, its president and general manager, the company operates 30 airplanes, including 14 Fords. More than a dozen pilots are regularly employed and the only complete maintenance base between Brownsville and Panama is the TACA unit where there are 38 spare Wasps, and 23 spare Wasp Jr., Wright and Lycoming engines.

Flying 850 hours each month, TACA's usual traffic averages 2000 passengers, 500,000 lbs. of express and a good number of pounds of air mail during a thirty-day period. Mail is carried under contract serving four republics and under ten concessions. Countries served include Guatemala, Honduras, Salvador and Nicaragua. Express is at present the second greatest source of income, such items being carried as tractors, graders, live stock and raw chewing gum.

TACA was founded, developed and is now owned and operated by its pilots who visualized air possibilities in Central America five years ago.

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The Industry Approves Aeronautical FLIGHT and GROUND TRAINING

They say it with jobs

THE only Aviation training that *counts* is the training that gets you jobs . . . *good jobs*. For years we here, in the center of the country's air transportation industry, have been supplying the outstanding companies engaged in aviation with trained men. The concerns employing AERONAUTICAL graduates reads like a list of "Who's Who in AVIATION". A few are: American Air Lines, Northrup Corporation, Consolidated Air. Craft, the Beech Aircraft Company, Douglas Aircraft, Lockheed Aircraft Corporation, Curtiss Airplane and Motor Co., Kinner Airplane and Motor Co., Stinson Aircraft Company, Pan American Airways, Chance Vought Aircraft Co.

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Tuition is really low for what you get. Equipment is complete . . . the latest and finest that money can buy. Our staff of instructors are not only expert in their respective fields, but are understanding educators as well. In and around Chicago there are more than the usual opportunities for part-time work. Whether you take our day or evening courses, schedules are arranged to insure maximum progress in minimum time.

If you are interested in *FLIGHT INSTRUCTION* then we offer you equally fine facilities for learning to fly through *The NORTH SUBURBAN FLYING CORPORATION*, at Glen View, Illinois. Curtiss Airport, on which the administration building shown above is located—and where all flying instruction is carried on—is one of the country's largest and finest airports for student instruction. Here you are given every opportunity to fly a great variety of ships and procure the government approved instruction for your Transport, Limited Commercial, Private, or Amateur License.

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SEE FOR YOURSELF ★ ★ Nails and glue, brittle spruce, inflammable cellulose coated muslin, as materials for airplane structure, must go if private flying is to progress as it deserves. You are invited to view at first-hand the interesting development in metal construction and all that goes under the paint, here at West Trenton.

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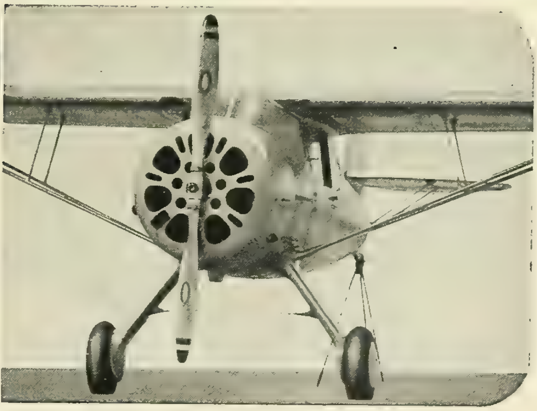

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No. 36 Bartow Beacon

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STANAVO

AVIATION GASOLINE
AVIATION OIL
ROCKER ARM GREASE

THIOKOL

(*Continued from page* 29)

elastic material, which is not attacked by gasoline or benzol, is marketed under the trade name of *Thiokol*."

Tests were accordingly made with cemented *Thiokol*-lined containers which were dropped from a height of 14 feet 6 inches to a concrete floor. There was a small leak through the cemented seam but no break in the *Thiokol*.

Tests with molded *Thiokol* containers were also made and the conclusion was arrived at that crash-resistant tanks of a weight approximating 1.4 lbs./gal. could be constructed using this type container. For an example of this, a tank with molded inner container was dropped 20 ft. to a concrete floor and there was no leak in the *Thiokol* although the metal covering was severely damaged.

Two related uses of *Thiokol* are the uses of a liquid sealing cement to seal gasoline tanks as a precaution against accident, and to repair gas tanks in which minor leaks have developed. Pan American Martin Clippers are an example of this first application.

Repeated landings are likely to spread the metal plates in the bottoms of these ships which protect the tanks and result in leakage into the tanks if they are not protected by the material in the seams. The cement is sprayed inside the plates so it will flow into the gap formed should any plate fail to prevent water from entering.

The Navy has been testing *Thiokol*-coated balloon cell covering cloth for lighter-than-air craft. In the *Los Angeles*, anchored at its mast at Lakehurst, there is a gas bag made under the supervision of the Bureau of Standards. Tests of this bag, ranging over a period of years, have proved that *Thiokol* is better than rubber for preventing the escape of helium. It also offers more protection to the cells from external injury due to its tensile strength. What with the proved practicality of transoceanic passenger travel, evidenced by the *Hindenburg*, this fact will undoubtedly become an important asset to future development in lighter-than-air transportation.

The increasing practice of American airlines in sending their planes to higher altitudes in efforts to speed up schedules has brought about another application of *Thiokol* for sealing the fuselage, windows and doors of these planes. Such air proof construction is recommended for new ships, as a precaution against air sickness in rarified atmosphere.

In addition to these specific applications of *Thiokol* by the aviation industry, there is a multitude of uses for this oil-proof, moisture-proof synthetic rubber for gaskets, washers, and miscellaneous tubings where its unique characteristics recommend its use.

NICKEL STEELS

(*Continued from page* 39)

esting application. An exhaust collector was designed to serve also as a heating medium for the carburetor air intake line, in order to prevent the formation of ice. The material out of which manifolds are made must possess high temperature strength, resistance to atmospheric corrosion, to attack by burnt anti-knock gasoline, and to failure because of vibration and rapid temperature changes.

What may yet come in the way of improved construction materials or new applications of existing materials is difficult to predict. However, as Glenn D. Angle pointed out in the April 1936 issue of AERO DIGEST, more recent developments, at least in America, have been confined largely to detailed refinements involving the application of the most advanced knowledge of materials of construction and methods of manufacture, rather than the use of new and varied designs. Thus we may expect further reductions in weight to be slight, but improvement in engine performance, reliability and economy to be consistent and considerable.

AIRCRAFT FINISHES

(*Continued from page* 45)

is important to clean it down thoroughly with naptha, benzine or oil-free and ethyl-free gasoline, and then wash the surface with soap and warm water. A final rinse with warm water will eliminate any residue. Sanding the old surface is never recommended. It is always advisable, however, to spray on a wet coat of binder thinner or remover after the surface has dried and before applying the pigmented dope. In cases where the finish is still in good condition, but tautness has been lost, it is possible to tauten and brighten the finish by applying two cross-coats of pigmented dope after preparing the surface. Where the old finish is inclined to crack under the thumb and recovering does not seem essential, the old finish can be washed off with wax-free dope remover. The little dope that remains will not matter. In general, it must be remembered that in refinishing over an old surface, either the same color or a darker shade must be used in order to hide the old color in a minimum number of coats.

When it is desired to match repairs in fabric ruptures with the surrounding finish, wipe the area around the tear for several inches with dope remover. Then soak it with a second application to allow scraping off the old dope with a spatula or putty knife. If the tear is large it should be sewed. The patch should then be cut so that the edge will extend about 2 in. beyond the tear and the edges pinked or frayed for about ¼ in. The patch and area to be repaired should then be given a coat of dope which is allowed to dry and followed by a second coat which serves as an adhesive. From this point on the patch should be given the same finishing consideration as the rest of the plane. As a final touch the patch may be blended in by spraying on a coat of thinner, which when thoroughly dry may be rubbed to a gloss with polishing compound. Where

(*Continued on following page*)

AIR ACES, LIKE AUTO ACES, USE PYROIL

For the 4th straight year, Pyroil scooped the Indianapolis 500-mile auto race with 30 of the 33 starters and 9 of the 10 winners this year using Improved Pyroil!

Pyroil enjoys equal prestige among aces of the air. Used by transport lines, race pilots and private planes alike.

Improved Pyroil protects in an emergency of oil loss, thinning or failure. Increases R.P.M. Reduces wear. Cuts operation costs. Write for complete details and what famous air men say of Pyroil. Use Improved Pyroil regularly. Sold everywhere. Manufactured and Guaranteed by PYROIL COMPANY, W. V. Kidder, Fdr., 146 LaFollette Ave., LaCrosse, Wis., U.S.A.

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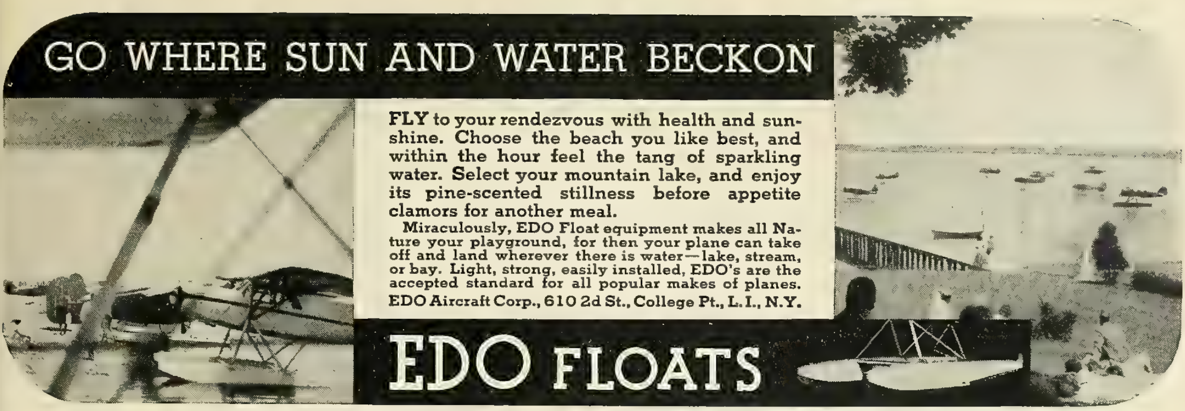

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FLY to your rendezvous with health and sunshine. Choose the beach you like best, and within the hour feel the tang of sparkling water. Select your mountain lake, and enjoy its pine-scented stillness before appetite clamors for another meal.

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For further details refer to RCA advertisement on Page 15, this issue

RCA

PORTERFIELD TWO-PLACE CABIN PLANE

"The Unchallenged Leader of Its Line"

The Little Ship for Big and Little Men—Flies beautifully with two 6-footers, at 225 pounds. A 350-mile cruising range at $1 per flying hour.

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A WIDE POWER-RANGE VARIETY
and convenient to buy
Our Club Ownership Plan
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Write for "Clevenger's Flight Manual" . . . Knows all—tells all

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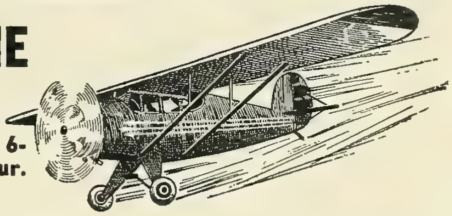

PROPELLER DE-ICING

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PROPELLER HUB SPINNERS RUBBER COVERED

Approved and recommended by Transcontinental & Western Air Inc. and Goodrich Rubber Co.

We manufactured the first slinger ring de-icer and propeller hub spinners used in transport service.

Our equipment used exclusively by all leading air lines.

We are in constant collaboration with transport engineers in developing and improving propeller de-icing.

DURAL COWLINGS & PARTS EXHAUST STACKS

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"The Drop-Forging People"
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STANAVO

AVIATION GASOLINE
AVIATION OIL
ROCKER ARM GREASE

(*Continued from preceding page*)

patches and tape overlap, the job may be made neater by applying the patch under the tape.

The finishing of aluminum alloy ships is a live and moot subject, and this article makes no attempt to discuss the pros and cons, but points out recommended procedure where painting is to be applied to duralumin parts. Oil, grease and other extraneous matter should be removed with dope thinner or a chemical cleaner of the phosphoric acid type. Vinegar should never be used. The surface may be sanded with No. 320 paper or lightly sand-blasted. Anodizing aluminum and dural is the most satisfactory method of preparing the surface for painting. Whether sanded or anodized, a light spray coat of red oxide primer should be applied to the clean surface. Bare hands should not be allowed to come in contact with the clean metal surface before priming. Pyroxylin primers are never recommended for aluminum or aluminum alloy airplanes or pontoons. The red oxide primer may be baked at 225° for two hours or air-dried for from 16 to 20 hours. Two or three coats of lacquer or synthetic enamel in the desired color should be sprayed over the primer. After the last coat of lacquer enamel has dried for two hours or more the surface will be ready for polishing to a high gloss with lacquer polishing compound. Synthetic enamel need not be polished. A smoother surface may be obtained by water-sanding the second lacquer enamel coat with No. 320 carborundum-type paper before polishing operations are begun.

Steel surfaces require the same care in sanding and cleaning as aluminum does. Fuselage tubing should be given either two heavy coats of oil primer, or one light coat primer and two or three coats of enamel. The interior of fuselage tubing is important because corrosion proceeds unseen. Small holes approximately 1/16 in. in diameter should be drilled in the longerons at the points of intersection with the compression members prior to welding. Thinned spar varnish may then be forced through the entire inner surface from a hole in one of the lower longerons until the tubes are filled and either allowed to drain off or forced out under low pressure. By then sealing the external holes with brass drive screws the fuselage may be made practically air and water tight. Engine enamels are best applied by spray, but may be brushed on or dipped. Oxide scale or flaking enamel should be wire brushed off. The old paint may be completely removed by a caustic solution and the surface sand-blasted to give the enamel better tooth. Tough, durable and resistant enamels are available in black, deep gray, or in heat resisting aluminum bronze and are applied by brush or spray, slightly reduced.

PLASTICS

(*Continued from page 31*)

ing on filler, color and other requirements.

Instrument cases and instrument parts, ignition system parts, control pulleys and camera parts are among those which are molded from phenolic compounds in aircraft applications. Cases for Pioneer altimeters and airspeed indicators are molded from *Durez* phenolic compound because the resulting case is strong, light and corrosion resistant and requires no applied finish. Each mounting lug is tested to withstand a pull of 175 lbs.

Molded and laminated *Bakelite* (phenolic) parts are used in the 275-lb. 10-lens Fairchild aerial mapping camera. Such parts are strong and light, retain their shape and finish indefinitely, are good dielectrics and have high resistance to moisture, oil and changes in atmospheric conditions. Such parts can also be held within fairly close dimensional limits and are readily and rapidly duplicated in production, but require some investment—often considerable—in molding equipment.

Cast phenolics have many properties in common with the molded type but, unlike the latter, are available in clear and colored transparent and translucent forms and in all colors. They are cast, rather than molded (as their name indicates), usually in slabs, rods or tubes, which are subsequently machined in much the same way as wood or soft metal. Their principal use is decorative, but in aircraft they have been used for instruments in which transparency is a factor. They make excellent and attractive handles and knobs. Such parts are easily turned out and require no molding equipment. The cast phenolics range in price from about 45 cents a pound upward, but being light in weight, volume per pound is large.

Urea plastics mold somewhat similarly to the phenolics. They have not gained extensive use in aircraft but might well be used for some applications where translucency and light color is desired. In automobiles they are used for instrument dials, dome-light covers and knobs, among other applications and might well find similar use in aircraft, since they are much lighter in weight and much less friable than glass. Dishes molded from urea, being much lighter than china, are used by some airlines. They come in attractive light colors and white, withstand washing and contact with foods and are not easily broken. The cost of urea compounds per pound (about 30 cents upward) is greater than for most molding phenolics, but the latter are not available in white or light tints, and are not translucent. Although some laminated urea plastics are available, their use is limited and the writer does not know of any aircraft applications. Properties are similar to those of the laminated phenolics, if the same paper or fabric is employed, but since the phenolics are lower in cost, urea laminated is confined to white or light tints and is likely to be chosen primarily where translucency is desired. Now that thin laminated translucent sheet of a special phenolic form is being developed, however, laminated urea applications may be still further narrowed.

Synthetic rubber finds use in aircraft, as in other applications, primarily because of its ability to resist the solvent and softening effects of fuels and lubricants and because it is available in flexible forms having much the same physical properties as natural rubber, but without the disadvantages of the latter in swelling and deterioration in contact with oil and/or fuel and under exposure to light. Tubing made from synthetic rubber is used for fuel and oil lines because it is not subject to failure from vibration and is not affected by the liquids it carries. Parts which may be exposed to sunlight are not injured or hardened by this exposure. (A detailed discussion of synthetic rubber appears in an article on p. 29.)

Much more might be added about the properties and applications of plastics suitable for aircraft, but those given are sufficient to indicate the value plastics possess for the aircraft producer and user.

PERSONAIRLITIES

(*Continued from page 92*)

United States for the benefit of Howard Coffin and associates, and what should be bought in England and Europe, for the benefit of foreign manufacturers. In two months the Mission made a report which, to the astonishment of all at the time, received the unanimous endorsement of the Air Service Headquarters in France, England, and Italy. With what we have learned since about the French, English, and Italians, there is now little doubt that the report must have let us in for a proper trimming, or there would have been protests from all our brave and honest allies.

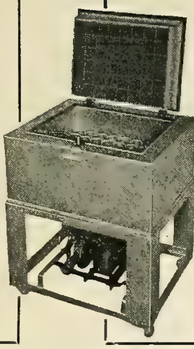
On August 1, 1917 General Pershing retained Capt. Gorrell as Chief Engineer Officer of the Air Service, A.E.F., and for the next two months Gorrell handled all the engineering activities of the Air Service. During this period he bought $77,000,000 worth of material including airplanes, engines, radios, guns, buildings, and everything an air force needs, including whisky.

From November 24, 1917 until February 3, 1918 Gorrell, now a Major, acted as Assistant Chief of Staff of the Air Service, A.E.F., laying the ground work for all air activities, when he was transferred to the Operations Section of the General Staff, and there handled all aerial strategy and other aerial matters, synchronizing them with the activities of the rest of the Army. Towards the end

(*Continued on following page*)

PRESENT USERS

Consolidated Aircraft Corp.
Seversky Aircraft Corp.
Glenn L. Martin Co.
Bell Aircraft Corp.
U. S. Army Air Corps—Wright Field (*also Hawaiian Air Depot*). War Department—Quartermaster Corps (*Washington, D. C.; Middletown,, Pa.; San Antonio, Texas; San Diego, Calif.; Canal Zone.*)



A PORTABLE, LOW TEMPERATURE, ELECTRIC FREEZING UNIT FOR TREATING ALUMINUM ALLOY RIVETS

DESIGNED especially for aircraft manufacturers, the Jewett Refrigerator is far advanced over previous make-shift types of freezing units. In comparison with dry ice boxes, it costs but a fraction to operate. Incidentally, this unit—while maintaining a constant predetermined temperature of usually 0° F.—will not frost, as dry ice will.

Contains 48 individual containers of approximately 19 cubic inches capacity each. An index board on the cover, laid out in squares corresponding in position to the containers, provides a convenient guide to the location of the various size rivets.

The entire unit, on casters, measures 36" high and requires a floor space of only 31½" x 26½". Uses a 1/6 H.P. motor of either 25 or 60 cycle, 110 or 220 volts; and consumes approximately 5 KWH in 24 hours.

We also produce low temperature equipment for the treatment of aluminum alloy stampings.

Manufacturers are invited to write without obligation for more complete information.

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Generous Shock Travel
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Completely Streamlined
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ALGOMALOID—structural plywood corresponding to Duraply specifications.

ALGOMETL—wood combined to steel, superior to any other metal-faced plywood.

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(*Continued from preceding page*)

of the war, Gorrell was made Chief of Staff of the Air Service, A.E.F., with rank of Colonel, and finally when peace broke out in all its fury and back-biting he represented the United States in a number of conferences during the so-called Peace Conference and at the International Convention on Aerial Navigation. Our enviable record of never losing a war and never winning a conference survived undamaged.

For distinguished service with the American Expeditionary Forces in France Col. Gorrell was awarded the American Distinguished Service Medal. The British Government awarded him the British Distinguished Service Order for meritorious service in the Allied Cause, and the French Government awarded him the Legion of Honor. They appreciated the way he helped the manufacturers. He was also awarded the "Victory Medal", for at that time it was believed that we had been victorious. Soon, however, it appeared that all we were to get out of our "victory" was a balloon, which the Germans gave us in a brief moment of gratitude for having come in and stopped a war in which all sides were feeling very fed up by 1917.

Summing up Col. Gorrell's Army career, we find in it an inspiration for the youth of the land. He displayed brains and ability, and therefore was considered too valuable to send over the lines and risk having him shot. He rose to high rank without having anyone shoot at him, which is a triumph of mind over munitions. Let that be a lesson to all you young officers in the Air Corps—gradually prepare yourselves so you'll be considered too smart to fight. Then in time you may survive to become Chief of the Air Corps. For as the poet says—don't ask me what poet—"The lives of great men all remind us we can make our lives sublime, and, departing, leave behind us footprints in the mud and slime." Or something like that.

After the war had been postponed—Col. Gorrell returned from Europe and was transferred to the Operations Section of the General Staff, War Department, Washington, D. C., the Promised Land of all Army officers. He was getting $12,000 a year, on account of flying pay, and thus was getting as much as General Pershing. Yet he gave it all up, resigned, and went to work on the scrap pile of the Nordyke & Marmon automobile factory at $25 a week! How can you explain a man like that? He decided he had reached the pinnacle more or less so far as the Army was concerned. He wanted another field to conquer. Within a short time he was in charge of sales—recognizing genius the Marmon people had retrieved him from the junk pile. He had the Marmon completely redesigned, was responsible for the advertising campaign which is still considered a model and one to be remembered in automobile advertising; and soon had the company out of the red. Within two years after leaving Marmon, it was again in the red. He went with Stutz Motor Car Co. when it owed $14,000,000, thought up and executed new manufacturing and sales ideas, and put the company back on its feet. He left in 1929, and they are again in the red. Surely this cannot be merely a coincidence. He might even do something with the N.A.A. But I don't know—it's hard to win races with a dead horse.

And now Col. Gorrell has come, like Moses of old, to lead the children of transport aviation into the promised land, out of the bondage of the Egyptians. He made a good start in Washington, especially with his testimony before the hearings. If he was clever enough to get two automobile companies out of the red, perhaps he may be smart enough to get the air transport business out of politics and under a non-political body.

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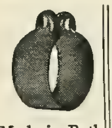

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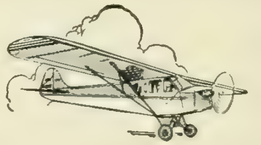

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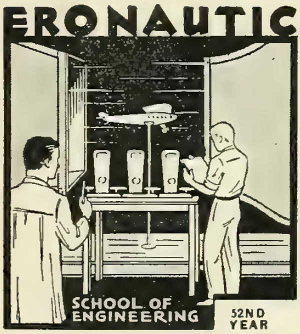

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Very little time; excellent shape.

AERONCA, 1935 MODEL $1,600
Lights, battery, brakes, radio. Very good condition.

LOENING COMMUTER $2,500
Wright J6-9, 330 h.p. Wonderful shape.

WASP ENGINE SED-1...$5,000
550 h.p. at 11,000 ft.; 830 h.p. at sea level. No time since complete rebuild.

ROBIN CHALLENGER 180
..........................$1,300
Good condition.

PITCAIRN PA-7.........$1,800
All blind flight instruments; radio; new engine. Large payload.

STINSON S..............$1,800
Motor just majored; good shape.

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PENOBSCOT BLDG.
DETROIT, MICH.

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Aeronca

AERONCA SEAPLANE: Completely overhauled and conditioned for salt water. Special white finish with red trim. Very attractive and in perfect condition. Price, $1,400. Viking Airport, Inc., Box 3302, Miami, Florida.

AERONCA C-3: 2-place; excellent condition; 20 hours since majored. $700 cash. Four complete OX-5 motors, $50 each. New OX-5 parts, lowest prices. Blue Ridge Airways, Waynesboro, Pennsylvania.

AERONCA C-3: 1934. Good shape. E-113-B motor. Electric oil heater, navigation lights, landing light, air speed, wheel fenders. $900. Goodwill Air Service, Bernharts P. O., Pennsylvania.

AERONCA C-3: Licensed to June 1937. One year old, like new; perfect condition. Total time 250 hours. Thompson Airways, Inc., Curtiss-Wright Airport, Baltimore, Maryland.

AERONCAS: Used, latest models, high and low wing. Also new Aeroncas. Prices upon request. United Aero Corporation, P. O. Box 222, San Antonio, Texas.

AERONCA C-3: New condition, 350 hours since new, 50 hours since complete cover job and major overhaul, including engine. Sell or trade for larger cabin ship, regardless condition. Send offer. G. C. Lucas, 3917 State St. Drive, New Orleans, Louisiana.

AERONCA C-2: Licensed June 1937. Hours since major, 30. Airwheels, split type landing gear, new prop, fabric, tires, and cylinder assembly. $350 cash. Fritz Schrom, Berwyn, Maryland.

AERONCA C-3 CABIN: Cabin heater, licensed, perfect condition; 10 hours on motor since factory overhaul; always hangared and privately owned. Will sacrifice for $750. Box 15, Cumberland, Md.

AERONCA C-3: New June 1933; 100 hours since major overhaul; just relicensed; equipped for night flying; winter enclosure and heater. AERO DIGEST, Box 2344.

AERONCA C-3: Late E-113-A motor; oleo landing gear, fully equipped; licensed until July 1, 1937. Fabric perfect. $800. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

LOW-WING DEMONSTRATOR: 70 h.p. LeBlond. Two months old, less than 100 hours total time. $390 of extra equipment includes air brake, navigation and landing lights, battery, bank and turn, rate of climb, cabin ventilators. Price, $2,700. Basil Aviation Co., Pennsylvania Municipal Airport, Philadelphia, Pennsylvania.

AERONCA LOW WING: 70 LeBlond, 160 hours, flap, landing and navigation lights; like new, $2,400. English Avian with spare motor, excellent condition, 550 hours, $650. Tred Avon Flying Service, Easton, Maryland.

AERONCA C-3: New September 1935; 150 hours total time; just top overhauled, A-1 condition throughout, $1,425. Munch & Romeo, Inc., Hangar 7, Roosevelt Field, Mineola, New York.

AERONCA: 1934, in perfect condition; recently majored; $950. Winter enclosure, wheel pants. John Patouhas, 556 North Avenue, New Rochelle, N. Y.

LATE '34 AERONCA: Few hours since factory major; streamline wheels, oleos, enclosure, duals, heater; A-1 condition. $375 down. Leeward Flying Service, New Kensington, Pennsylvania.

1934 AERONCA: 10 hours since complete major on motor; total ship time 400 hours; price, $985. Captain W. E. Huddleston, P. O. Box 162, Santa Fe, New Mexico.

American Eagle

OX-5 AMERICAN EAGLE Biplane: Licensed to October 15th. Fabric perfect. Refinished completely. Like new. $350; $100 down and $25 monthly. Aviation Finance Co., Hemlock, New York.

AMERICAN EAGLE: Model 201, 3-place; front exhaust Kinner. 150 hours since real major. Privately owned. Never cracked. Covering excellent. Airwheels, compass, battery booster, air speed, clock, navigation lights, duals. Appearance and performance similar to Fleet. Complete logs. Licensed until November. Owner leaving country; must sell. Bargain at $950. Apply S. R. Guest, Congressional Airport, Rockville, Maryland.

AMERICAN EAGLE: Kinner front exhaust. Excellent condition. Compass, air speed, Lunkenheimer. 450 hours total. Red fuselage, desert sand wings. Price $650 cash. Queens Chapel Airport, Hyattsville, Maryland.

FOR SALE: American Eagle, OX-5 motor. Ship just recovered and relicensed. 30 x 5 wheels and tires. $425 or will accept late model car. Waco Cabin, $2,500. Wire or write Clayton Lemon, P. O. Box 2144, Roanoke, Virginia.

SELL: 1933 Salmson Eaglet, enclosure, clock, air speed; licensed to June 15, 1937. Excellent condition. Priced for quick sale. Benn Herr, Lebanon, Ind.

Avro-Avian

CIRRUS AVIAN: No time since major. Covering A-1. Duals, slots, full air wheels, folding wings, oleo shocks. A-1 shape all around. Licensed to February 1937. Price $525 cash. Will trade. Soames, Peru, Indiana.

AVRO-AVIAN: Just completely overhauled and relicensed. Slots, airwheels. Will sell or trade for ship needing repairs. V. Dale Schurr, Linfield, Penna.

AVRO AVIAN: NC licensed; good condition. Cirrus engine, standard instruments, wing slots; large wheels; approximately 380 total hours. Original logs; engine recently overhauled. $475. Flyaway Milwaukee; no trades. E. B. Mulick, 1429 Martha Washington Drive, Wauwatosa, Wisconsin.

Barling (N-B)

BARLING NB-8: Two-place, powered with Genet 80 h.p. Licensed till February 1937. $500 cash. Will trade. Ben A. Funk, Highway No. 50, Grover, Missouri.

Bellanca

BELLANCA J-5; Licensed to June '37. Payload, 1100 lbs.; 7 hours cruising. Hole for photography. Brakes, tail wheel. Priced right for real bargain. Holmes Flying Service, Holmes Airport, Jackson Heights, New York.

Bird

BIRD: KINNER B-5 (late type): semi-airwheels, Heywood starter, cockpit cover, navigation lights, compass and all standard instruments. This was one of the last ships built and has been privately owned, never cracked or commercially operated, always hangared. Original logs show 275 hours honest time. Both ship and engine condition perfect. High gloss blue and gold finish. Must see ship to appreciate. $1,500 cash, no trades; flyaway Milwaukee. Ed. Rogers, 1029 West Wells Street, Milwaukee, Wisconsin.

KINNER BIRD: 100 h.p.; good condition; motor just majored in our Government Approved shop; semi-airwheels, standard instruments, $1,250. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

KINNER B-5 4-place Bird: With many extras. Just relicensed. Privately owned. Trades considered. C. F. Herrington, 209 East Mifflin Street, Madison, Wisconsin.

KINNER K-5 BIRD: Entire ship in excellent condition; motor overhauled recently, wings recovered and entire ship refinished. Special equipment includes landing and navigation lights, flares, steel propeller, Goodyear Airwheels, Heywood starter, duals, oil thermopete, clock, etc. Ship is privately owned and must be sold; an unusual bargain. $1,275 cash. Photograph available. J. Slager, 434 Solon Street, Toledo, Ohio.

Beech

BEECHCRAFT B-17-L-4: Jacobs 225. Ship and engine 84 hours total. Turn and bank, radio, thermocouple, electric starter, extra gas tanks, special upholstery. Must sell; sacrifice at $5,500. John Rintoul, Hangar 9, Roosevelt Field, Mineola, New York.

BEECHCRAFT: 225 Jacobs; 310 hours; Curtiss metal propeller, 70-gallon tanks, R C A radio, flares, landing and navigation lights, Kollsman sensitive altimeter, turn and bank, thermocouple, high rate generator; Irving QA parachutes; cream and blue colors, leather upholstery; at 285 hours Jacobs factory majored and modernized with latest 1936 cylinders, heads, crankcase, push rod covers, etc., instead of topping. Propeller etched and checked at 305 hours. Beechcraft factory completely checked and made all possible adjustments and repairs. Cruises 155 sea level, over 165 at 8,000, recommended r.p.m. Average speed last 160 hours, including take-off, climb and landing, 149 m.p.h. Less than 15-gallons per hour. With such complete renovation, costing over $600, ship is practically as good as new. Original cost over $10,000; price, $5,995. Hubert Williams, 1086 Seyburn Avenue, (Telephone Fitzroy 6377) Detroit, Michigan.

BEECHCRAFT: 225 h.p. Jacobs, factory rebuilt, cannot be told from a new plane. Equipment: Oil temperature gauge, tachometer, altimeter, air speed indicator, electric starter, generator. Priced to sell, $5,000. The Beech Aircraft Company, Wichita, Kansas.

BEECHCRAFT DEMONSTRATOR: Wright 440. Four months old, 150 hours total time. In perfect condition and never cracked. Cruises 208, lands at 50. Has all blind flying instruments, clock, thermocouple, manifold and carb. air temperature, landing lights, flares, Lear radio, Cambridge gas analyzer, 120 gallon tanks. Ship cost $16,500. For financial reasons will sell ship for $10,500. Mouton & Six, San Francisco Airport, San Francisco, California.

Boeing

BOEING: DH4 M-1 Liberty engine, Hamilton steel propeller. Can be used for banner towing, advanced student work, crop dusting or trade school. Bargain for quick sale. AERO DIGEST, Box 2345.

Buhl

BUHL HIGH SPEED Monoplane: 420 Wasp, just overhauled, 3 POLM. Price $2,000. Trade-ins considered. Also overhauled Horizons, $160. Frank Ambrose, Inc., Jackson Heights, N. Y.

BUHL PUP: No time since complete overhaul and recover; metalescent finish, Army yellow and blue. Reinforced fuselage, airwheels, compass, clock, airspeed, navigation lights, etc. $475. I. Robbins, 1159 Metcalf Avenue, Bronx, New York.

BUHL PUP: Perfect condition. Motor majored and plane reconditioned. Just the plane to build up time economically. $465 flyaway. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

BUHL PUP: Licensed; Szekely 45 h.p. New type motor, just majored. Ship recovered by Parks Air College last November. Everything O.K. Price, $495. Wilson E. Denlinger, 1116 Everett Drive, Dayton, Ohio.

SZEKELY BUHL PUP: Recently majored; licensed to June, 1937. Never cracked, looks and performs like new. Price, $375. Richard Carson, 265 S. Second St., Chambersburg, Penna.

Caproni

CAPRONI: 2 POLB, Gipsy powered. Airwheels; engine majored April; ship recovered and painted March; duals, new prop, instruments, cables, wiring, gas lines, bushings. Fast. Licensed to June, 1937. $590 or trade on three-place J-6 job. Eagle Hotel Corporation, Kingston, N. Y.

Cessna

J-5 CESSNA: Newly recovered; full airwheels, brakes, air tail wheel, speed ring. If you want a fast cabin airplane for cross-country, here it is and the price is right. Trades considered, terms to responsible buyers. Edw. A. Forner, Jackson, Mich.

Cub

FOR SALE: 1935 Taylor Cub, licensed till October 15, 1936. Excellent condition. Complete with enclosure, $950. Terms if desired. S. R. Guest, Congressional Airport, Rockville, Maryland.

TAYLOR CUB: Like new; Continental motor; 165 hours. Privately owned. $700. C. O. Hadley, 109 North Ninth Street, Reading, Pennsylvania.

1935 CUB: Special Stinson type paint job. Ship and engine in perfect condition. Looks better than brand new. Sacrifice for $900. Columbus Airport, Columbus, Georgia.

TAYLOR CUB: A-40-2; winter enclosure; about 700 hours on airplane. Motor in good condition. Licensed to July 1937. $700. Poughkeepsie Aviation Service, Poughkeepsie, New York.

TAYLOR CUBS: 1935 models. Bargains, $850 up. Eaglet, just refinished, $498. Rearwin Sportster. Also other makes. All can be financed. Bennett Air Service, Taylor Cub Distributors, Hightstown, New Jersey.

TAYLOR CUB: Continental; licensed and in good condition; $850. Fred Vilsmeier, 869 East Luzerne Street, Philadelphia, Pennsylvania.

1935 CUB: Licensed till May 1937. 250 hours total, 75 since major. New propeller and late carburetor. Never cracked and now in good shape. $925, cash only. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Penna.

Curtiss Jr.

CURTISS JUNIOR: A-1 condition. Ideal for small fields. Any reasonable cash offer or good car considered. Stanton, 125 Park Street, West Haven, Connecticut.

CURTISS Jr.: 106 hours total time. Motor just majored. New reinforced crankcase. Detachable motor mount. Scintilla mags. Wings recovered. Fuselage refinished. Beautiful color scheme. Positively can't be duplicated. Appearance like new. Never cracked or abused, had best of care. Just the ship for the small field. Must be seen to be appreciated. $465, includes new license, free flying instructions to buyer or buyers. Must sell to keep peace in family. J. Tamack, 2221 Hunting Pk. Ave., Philadelphia, Pennsylvania.

CURTISS JR.: Recently recovered and majored, excellent condition. Far exceeds other Juniors. Economical to operate. Only $450. Wire for preference. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

CURTISS-WRIGHT JUNIOR: $390. Licensed to June 1937. Motor and ship excellent condition. Richard O. Gordon, Bendix Airport, South Bend, Indiana (care Tockert).

Curtiss Robin

CURTISS ROBIN OX-5: Licensed. Ship and motor perfect. Spare motor and skis. Never cracked. Little time. $650. C. J. Morey, 605 West Broadway, Minneapolis, Minnesota.

OX ROBIN: Licensed, perfect throughout; new covering and upholstering; steel prop. Cash or trade for licensed Aeronca, Cub, OX Travel Air. Write details. F. C. Williams, Jr., Baker, Montana.

CHALLENGER ROBIN: 185 h.p.; 115 hours on engine since new; 10 hours on ship since completely recovered and reupholstered. Hamilton steel prop, landing lights, dual controls, and many extras. Licensed to December 1936. $1,050. Ralph Pretty, 3928 Folsom, St. Louis, Missouri.

CHALLENGER ROBIN with air starter, adjustable steel propeller; just refinished. Airwheels, bank and turn, tail wheel. Like new. $1,200. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

TANK ROBIN: 152 hours on motor, 250 hours on ship. Excellent. Full airwheels. $600. Thomas W. Palmer, 129 East Fourth Street, Frederick, Md.

ONE CURTISS ROBIN: OX-powered; compass, dual controls; Robin colors; small total time, exceptionally good motor; instruction if desired, free. Must be seen to be appreciated. $450. Terry Noll, Bellefonte, Pennsylvania.

CHALLENGER ROBIN: No time since new pistons and rings. Ship refinished, licensed until May, 1937; duals, brakes, air speed, bank and turn, pants, speed rings and adjustable steel propeller. Price $900. Will accept late model car on deal. Ernest Medkief, Hereford, Texas.

Doyle

DOYLE 2 POLM: LeBlond 65. Airplane and engine in excellent condition; 220 hours. Engine has new type master rod. Complete instruments and licensed to April 1937. $480 cash. N. F. Scudder, Route 3, Hampton, Virginia.

Eaglerock

EAGLEROCK: Late model center-section; OX-5 motor. Licensed, good condition. Have purchased new plane. Will sell Eaglerock at $350. E. I. Schrat, R. D. No. 4, Clearfield, Pa.

LICENSED CENTER-SECTION Eaglerock: Latest type. Converted high compression OX-5 motor. Steel propeller; many spare parts; center section, ailerons, etc. $375. R. F. Sliker, 106 No. Fifth St., Newark, New Jersey.

HISSO EAGLEROCK: Bendix brakes, 30 x 5 tires, rebuilt Scintilla magneto; plane licensed to May 1937; $600. Baker, Albany Airport, Albany, New York.

BARGAIN: OX Eaglerock in A-1 condition throughout. Recently recovered; is stressed up to 220 h.p. Will accept late model car on deal. Central Air Service, Grand Rapids, Michigan.

Fairchild

FAIRCHILD 24: 2-place cabin. Cirrus motor. Good condition, never scratched. $1,450. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Va.

3-PLACE FAIRCHILD 24: 125 h.p. Warner, under 300 hours; less than 50 hours since major. Extras include radio, bank and turn, sensitive altimeter. Is steal at price asked. L. H. Pitkin, Sterling Building, Houston, Texas.

1935 RANGER FAIRCHILD "24": Radio, bank and turn, rate of climb, generator. Perfect condition. Owner trading for 1936 Ranger. Also 1936 Warner Fairchild "24" demonstrator. Colors blue and yellow, 30 hours total. Same as brand new. Max Marshall, Xenia, Ohio.

TO MAKE WAY FOR Fairchild Wright "45", we offer the following special cash prices. 1936 Fairchild "24", 25 hours, $4,995. Fairchild "24", 1935, special finish, bank and turn, booster, other extras, 289 hours, $3,850. Fairchild "22" special trainer, two complete instrument panels, each including bank and turn, rate of climb; brakes in both cockpits. Hood and radio for practice blind flight—only $2,150. Extra Gipsy engine, less lower case, $225. Switlik safety chute, new carrying case, $87.50. Air Activities, Inc., Municipal Airport, Houston, Texas.

FAIRCHILD KR-31: OX-5 motor; just relicensed Ship and motor excellent. Always hangared and never cracked. Next to last KR-31 built. $550. Sunset Airways, Chambersburg, Penna.

FOR SALE: Ranger Fairchild 24. Good as new. Flown only 160 hours. Blue fuselage with yellow wings and trim. Equipped with radio, landing lights and radio shielding. Price $4,400, at duPont Airport, Wilmington, Delaware.

KREIDER-REISNER Challenger: 125 Warner; just recovered and finished with X-47 enamel. Licensed to February '37. Price, $950. Sell or trade. D. R. Griffith, 28 Vermont Court, Asheville, North Carolina.

FAIRCHILD 22: C-7-D; Wright Gipsy, 90 h.p. 42 hours on ship and motor, 8 months old. Privately owned, perfect, never damaged. Consider trade on two new Cubs Fritz Schrom, Berwyn, Maryland.

FAIRCHILD 22: Military type windshields; high gloss finish, vermilion and cream; fabric like new. Switch and brakes both cockpits. Extra heavy drag wires installed. Very snappy, good performer. $1,350. Harold Pugh, Mgr., Municipal Airport, Burlington, Vermont.

FAIRCHILD 24: New 110 h.p. inverted Cirrus; ship 350 hours. Fabric and finish like new. Standard instruments. Must be flown to be appreciated. A real buy at $1,500. Harold Pugh, Mgr., Municipal Airport, Burlington, Vermont.

FAIRCHILD 22: Gipsy; less than 300 hours. Licensed till January '37. Has new appearance. Price $1,600. Captain W E. Huddleston, P. O. 162, Santa Fe, New Mexico.

Ford

FORD TRIMOTOR J6-9: Perfect condition, total time 905 hours. Equipped with changeable in flight night sky sign. $4,800. Link Aeronautical Corp., Binghamton, New York.

Fleet

FLEET DE LUXE: Model 8; 3-place; new June 1931. Ship excellent condition, licensed December 15th. Kinner B-5. Equipment: Sperry horizon, Kollsman altimeter, turn bank, rate climb, Crosley radio, blind flying hood, standard instruments, dual controls, brakes both cockpits, semi-airwheels. Price, $1,995. Will finance. With standard instruments only $1,650. Brayton Flying Service, Robertson, Missouri.

Gee Bee

GEE BEE BIPLANE: K-5 reinforced; 260 hours; brakes, tail wheel, navigation lights, booster, duals. License expires March, 1937. $800. Joseph Levy, 1250 Fairfield Ave., Bridgeport, Connecticut.

Great Lakes

FOR SALE: Silver Great Lakes. Plane and motor rebuilt for stunt flying by owner; no expense spared. Four hours since completion. Total 420. Extra instruments. Price, $1,200. Lieut. B. B. Talley, Wright Field, Dayton, Ohio.

GREAT LAKES 2T1A: Bargain. Always hangared, never cracked. Licensed to June '37. 16 hours since major. A-1 condition. $850. C. H. Fickes, 416 Fifth Avenue, Youngstown, Ohio.

GREAT LAKES TRAINER: De luxe late model 2T1A: 80 hours since majored; airwheels, brakes, upholstery, baggage compartment, compass, airspeed, metal propeller. Licensed to December. Must be seen to be appreciated. $1,250. Roger Gardner, Airport, Poughkeepsie, New York.

GREAT LAKES: De Luxe 2T-1A. Motor, Cirrus, just majored. Heads, rods, pistons, etc., new; ship excellent. Relicensed December. Upholstered cockpits, air wheels; Hamilton propeller. Completely overhauled. $1,375. Also new and used Cirrus parts. John F. Tilt, 902 American Bldg., Dayton, Ohio.

GREAT LAKES: 2T1A, just rebuilt, rubbed finish, snappy paint job; licensed until July, 1937. 450 hours, Jennings Bros., Worcester Airport, North Grafton, Massachusetts.

Invincible

INVINCIBLE: 4-place cabin; center-wing; Challenger motor. Brakes. Covering good. Unlicensed. Wheel control, duals. Ship good shape. Trade good light ship or good three-place open, Hisso's considered. Earl Sark, Mosheim, Tennessee.

Kinner

FOR SALE: For cash only. The most beautiful little seaplane in the country today. Kinner low-wing side-by-side seating. Edo floats with retractable rudders. Complete and licensed on wheels. Identified on floats for sport flying. Splendid performance and cruises at honest 94 miles per hour. Ship always privately owned by present owner and kept in hangar. Less than 300 hours on ship. Top overhaul at 250. Condition absolutely perfect. Never crashed. Pants, Townend ring, black body, white wings, gold striping. Price, $2,500. Marshall E. Reid, 1145 Broad Street Station Building, Philadelphia, Pennsylvania.

Lambert

LAMBERT MONOCOUPE: Total time 460 hours. 160 since major overhaul of motor. Extra instruments; steel propeller; speed ring. Always hangared. Price $1,050. Ralph W. Ransom, 1903 South Summit Avenue, Sioux Falls, South Dakota.

FOR SALE: DeLuxe Lambert Monocoupe; radio, bank and turn, rate of climb, wheel pants, steel propeller, motor 40 hours since factory overhauled. $2,800. Concord Silversmiths Corporation, Concord, New Hampshire.

VELIE MONOCOUPE 22: Perfect condition. 110 hours total time. Beautiful ship, privately used and licensed. $550 cash. Harold Dawson, Hoopeston, Illinois.

VELIE MONOCOUPE: Licensed, hangared. Fablin propeller with spinner. Split type landing gear; just refinished, blue and cream. $450 cash. Elmer Berg, Devils Lake, North Dakota.

MONOCOUPE: 125 Warner. 385 hours total time, ship and motor. Bank and turn, rate of climb, clock, rear vision mirror, thermopete, four ventilators, full air wheels, tail wheel, starter, ring, steel prop. Always privately owned; fabric and finish like new. A real bargain at $1,800. Harold W. Pugh, Mgr., Municipal Airport, Burlington, Vermont.

LAMBERT MONOCOUPE: Always privately owned; factory reconditioned engine just top overhauled; oleo landing gear; 650 hours; priced for quick sale, $950. Warner Monocoupe: Cruises 135, fastest 125 Warner Coupe in country; ship and engine excellent condition; 330 hours on ship. Racing type landing gear, pants, Townend ring and special racing cowling; color yellow and black; bank and turn, rate of climb, clyinder head gauge, Pioneer clock. If you are looking for plenty of power, this is the ship for you. $2,100. No dealers. Little Corporation, Patco Field, Norristown, Pennsylvania.

VELIE MONOCOUPE: Exceptionally good, recovered, refinished; new prop, completely overhauled, $550. Will consider trade on Warner Cessna with airwheels and brakes. Dewey Biggs, 5540 Harper Avenue, Chicago, Illinois.

VELIE MONOCOUPE: No time since majored. Recovered. Newly upholstered. Just relicensed. Real bargain, $575 cash. Will accept car in trade. Lynn Cook, 1515 You Street, N. W., Washington, D. C.

WARNER MONOCOUPE: Fully equipped with instruments. Streamline throughout; pants, ring, etc. Real snappy plane for pilot who appreciates performance. $1,350. Pioneer Aviation, Airport, Syracuse, New York.

LAMBERT MONOCOUPE: Late model. 18 hours on motor since majored. Snappy special paint job. Tunnel cowling, pants. $2,200. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

LAMBERT MONOCOUPE: Motor factory rebuilt, steel propeller, brakes, air wheels, never damaged, privately owned, relicensed May; 355 hours. $1,525. Central Aeronautical Corporation, Municipal Airport. Indianapolis, Indiana.

Lincoln

FOR SALE: Lincoln P-3. three-place open biplane; all new covering, enamel finish; OX-5 motor. A good buy and a hot looking ship. Make your offers. Must be sold! V. M. Rassner Flying Service, Peru, Indiana.

Loening

KEYSTONE COMMUTER with J6-9 Wright E. suped up to 365 h.p. Shielded for radio. Total time on ship and engine 450 hours; 120 since factory major. Excellent condition, superior performance. $3,500, cash; no trades. Can be demonstrated anywhere in Metropolitan area. Braman-Johnson Flying Service, Inc., Hangar B, Roosevelt Field, Mineola, New York.

KEYSTONE COMMUTER: Excellent condition, 270 hours. Wright D 330 with 135 hours since factory major. Just given top. F. G. Schenuit, Mt. Royal & Dolphin, Baltimore, Maryland.

Moreland

MORELAND M-1: 3PCLM. Relicensed. Ten hours since major and recover. Steel prop. Semi and brakes. Complete instruments, tail wheel, also extra J-5 parts and propeller. Bargain. Howell Bros., Pampa, Texas.

New Standard

NEW STANDARD D-25: J6-7 250 h.p.; steel prop. Motor and fabric fine condition. Excellent ship for passenger hopping. Licensed September 1936. $1,600 cash. Sam Antonio, P. O. Box 952, Beckley, West Virginia.

Pitcairn

J6-9 330 H.P. PITCAIRN Mailwing: Ship in excellent condition, loaded with instruments. Fully equipped for blind and night flying; electric starter and generator. Powered with Wright E-type motor. Trade accepted, or terms if desired. Edw. A. Forner, Jackson, Michigan.

Pitcairn Autogiro

PITCAIRN PA-20: 2-place Kinner autogiro. As new throughout; recently majored, high gloss finish. Safe, easily flown, lands anywhere. Free instruction, trades, deliver anywhere. Challenger Robin. Miller Flying Service, Montclair, New Jersey.

Porterfield

PORTERFIELD: LeBlond 70. Brakes, tail wheel, ring, navigation lights; 100 hours. Privately owned; like new. $1,600. F. B. Rowley, 4801 East Lake Harriet Blvd., Minneapolis, Minnesota.

PORTERFIELD: '36 model; LeBlond 70. Exactly like new; has air speed, brakes, speed ring, etc. 70 hours. Centrally located. Price $1,595. AERO DIGEST, Box 2349.

Rearwin

FOR SALE: Rearwin Sportster, LeBlond 70; new September, 1936. Total 163 hours. Ring, compass, air speed, air wheels. Always hangared, never cracked. A real buy. $1,495 flyaway. Rockwell Hardware, Watson Rd. at Southwest Avenue, St. Louis, Mo.

Ryan

RYAN B-5: J6-9 engine, completely overhauled last Fall; also Edo 3830 floats for same; spare steel propeller, instruments and J6-9 engine. David Powers, Eagle, Wisconsin.

Savoia-Marchetti

SAVOIA-MARCHETTI Amphibion: Kinner B-5 motor. Total ship time, 212 hours. Motor, 180 hours. Heywood starter, semi-air wheels, new Hartzell propeller. Extra fuselage tank. Complete set instruments. Licensed until June 1937. Privately owned, always hangared. Must sell. Price, $1,000. Maurice F. Healy, Oxford, Massachusetts.

Simplex

WARNER SIMPLEX W.S.2: ATC 238 NC14519. Licensed to March 1, 1937. Will sacrifice for $550 cash. Leonard Lundquist, Route 1, Romulus, Michigan.

FOR SALE OR TRADE: Simplex Red Arrow midwing, Kinner motor; new dope. J. J. Kirby, Smith's Grove, Kentucky.

Spartan

SPARTAN: Modernized J6-5, compass, turn and bank, other extras; brakes, steel prop; recovered high-gloss black and silver; never cracked; $1,200 or trade on Stinson. Will deliver anywhere. Hammond, 5200 Telegraph, Los Angeles, California.

FOR SALE: $700. 120 h.p. Walters Spartan 3-place biplane. Motor just majored; ship in excellent condition. Or will trade ship plus cash for 4-place cabin. Inquire Danbury Airport, Danbury, Connecticut.

Star

STAR CAVALIER: Velie engine, just 20 hours since complete major and modernization. Hand-rubbed covering job only six months back. A real airplane. Licensed. Price $625 cash. Will trade. Soames, Peru, Indiana.

Stinson

STINSON JR. SM2AB: J-5 motor. Ship just recovered. Motor A-1 condition. Hamilton Standard propeller. New tires. Licensed till November 1936. $1,100 cash. Charles Zosky, 511 East Virginia Avenue, Peoria, Illinois.

STINSON SR-6: Like new, under 150 hours; never cracked; color gray and red, gold trim. Two-way Lear radio; radio compass; 100 gallon gas capacity. Full night and blind flying equipment. Directional gyro; artificial horizon. Kollsman sensitive altimeter. Smith controllable propeller. Write to Westchester Airplane Sales Corporation, 292 Madison Avenue, New York, N. Y.

STINSON DELUXE R: Special color and upholstery, red and black. Large tanks; Wiley flares; duals, rate of climb, turn and bank, landing lights, etc. Always hangared, never cracked. Like new; just relicensed; $2,100. Wesley Airport, Wesley, Iowa.

STINSON 6-PLACE: J6-9. Good shape. 40 hours since major. Lear receiver, speed ring, blind instruments, other extras. $1,250. Hunter Bros., Sparta, Illinois.

SIX-PLACE STINSON J-6: 300 h.p. Complete set of instruments, brakes, landing lights, motor ring, radio, inertia starter. In excellent condition, just relicensed, $1,700 cash. Hayden R. Mills, 4100 Fullerton Avenue, Chicago, Illinois.

STINSON JR.: 4-place; J6-5 Wright motor; 66 hours total time. Licensed June 1937; ship refinished 1935; excellent condition; best offer accepted. Max McCotter, 1133 Rutledge Street, Madison, Wisconsin.

LYCOMING STINSON SM8A: Beautiful condition, leather interior; motor in perfect condition, fabric and finish like new. $1,100 flyaway. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

STINSON JR. (SM7B): Wasp Jr. (300) powered. Ship and engine in A-1 shape. Licensed till June 1937. Starter, generator, landing and navigation lights, flares, bank and turn, rate of climb, air temperature, clock, radio, ring, pants, extra large fuel tanks, etc. Complete details and photograph on request. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

LATE MODEL SR-5 STINSON: Like new. Powered with Wright E-type 250 h.p. motor. Everything on it. Priced to sell. Edw. A. Forner, Jackson, Mich.

TRIMOTORED STINSON T: Airliner, with electric starter, extra air wheel and tail wheel complete; 10-place cabin. Propellers reconditioned at factory; ship relicensed; metal bottom fuselage; flares, night flying equipment complete. The best Stinson T in service today. Cash, trade or terms. If interested write to Love & Wolke, South Main St., Jacksonville, Illinois.

TRIMOTORED STINSON MODEL T: Wings and tail group recovered past winter, equipped with latest type hydraulic brakes, heavy duty Goodyear low pressure tires; also spare tire; engines and propellers good, fuselage recently refinished. Licensed, 10 passengers and pilot. Price, $1,800. Two Challenger engines in good condition, $150 each. Two Curtiss Reed propellers for Challenger, $25 each. One Lycoming R-680 engine with 90 hours since top, now being overhauled, $350. Wasp-powered speedwing Laird, has generator and starter, about 450 hours total, excellent condition. Write or wire Mackey Flying Service, Findlay, Ohio.

Swallow

OX-5 SWALLOW: Biplane, licensed. New prop, air wheels; good condition, private owner. Orange, silver. Always hangared. $450. Lloyd Elliott, 719 Glenwood Avenue, Youngstown, Ohio.

Travel Air

OX-5 TRAVEL AIR: Licensed June '37. Semi-air wheels; motor and fabric perfect; duals, bolted motor mount; sacrifice, $485 (cash price). Howard Morders, 4533 Wisconsin Avenue, Washington, D. C.

J-5 TRAVEL AIR 4000: Just rebuilt and relicensed to April 1937. Motor excellent. Bendix wheels and brakes, Hamilton steel prop, starter and extra equipment. Sacrifice at $1,200. Robert Gandy, care TWA, Municipal Airport, Kansas City, Missouri.

OX-5 TRAVEL AIR: Millerized, covering excellent; 100 hours since ship rebuilt, 40 hours since motor majored. Air wheels, air speed. Licensed till December 15, 1936. $500 cash. Reading Aero Club, Box 114, Bernharts, Pennsylvania.

FORCED TO SELL: 125 h.p. Warner Travel Air. Perfect condition, recovered, motor just overhauled. Bendix wheels and brakes. Standard steel propeller, turn and bank, air speed, compass. Licensed May 1937. First $900 takes it. Wm. Morton, Route 7, Knoxville. Tennessee.

LICENSED E-4000 TRAVEL AIR: J6-5, Speedwing. 400 hours total time. Climb 1000 feet minute. Must sell, sacrifice $795. Paul Sliker, 106 North Fifth St., Newark, New Jersey.

TRAVEL AIR 3000: Licensed till March 1937. High gloss rubbed finish; complete set of blind flying instruments; brakes, steel prop; 180 Wright Hisso, recently majored, with Stromberg carburetor, two Scintillas; $895. Arthur Hyde, Congressional Airport, Rockville, Maryland.

J6-5 TRAVEL AIR: 3-place biplane. 20 hours since major on motor. No hours since completely recovered. Total time, ship and motor, 490 hours. Complete set blind flying instruments, starter, landing lights, tail wheel. Price, $1,350 cash. C. W. Blackwell, Palestine, Texas.

J-5 TRAVEL AIR: Plane just recovered and relicensed June 14th. Finished red and silver; motor 65 hours since majored; $1,000. Terms, $500 down. Wire for preference. Pioneer Aviation, Airport, Syracuse, New York.

TRAVEL AIR J-5: Special speedwing, with round front cowling, extended to rear cockpit. NACA cowling, compass, bank and turn, rate of climb. head temperature gauge and new tires. Paint and fabric perfect. Just relicensed. Total time motor, 320 hours; 50 since major. Price, $1.500. Will accept trade. Andy Stinis, Floyd Bennett Field, Brooklyn, New York.

Viking

KITTY HAWK SEAPLANE: In perfect condition. Motor just overhauled. Plane completely prepared for salt water. Price, $2,250. Viking Airport, Inc., Box 3302, Miami, Florida.

Waco

FOR SALE: OX-5 Waco, licensed. Plane is all new. Only 50 hours on all. Charles F. Dorsom, Garage, Gettysburg, Pennsylvania.

WACO 10 OX-5: Ten hours since major overhaul, airplane and engine. New Fahlin propeller. Motor turns 1520. Located near Milwaukee, Wisconsin. Licensed till May 1937. $395. AERO DIGEST, Box 2334.

TWO OX-5 WACO 90's: Unlicensed but in good flying condition; priced for quick sale. One Jacobs Waco A, perfect condition, $1,750. Columbus Airport, Columbus, Georgia.

FOR SALE: 1933 Waco Cabin with Continental engine which has just been overhauled and completely modernized by factory. Extra equipment: Landing lights, flares, bank and turn, wheel pants and steel propeller. Hand-rubbed finish in excellent condition. $3,300 at duPont Airport, Wilmington, Delaware.

WACO J6-5 STRAIGHTWING: Just rebuilt, engine majored and modernized; full airwheels, Hamilton metal prop. Exceptional. Will accept light ship as part payment. M. N. Brann, Vesper St., South Hempstead, L. I., New York.

FOR SALE: J-5 Waco; motor and ship in A-1 condition. Vermilion fuselage, silver wings. Must be seen to be appreciated; reasonable cash offers considered. Kenneth Joseph, West Chester, Ohio.

UNUSUAL WACO F: NC11258; 125 h.p. Warner engine, No. 906. One of the last Warner F's built. Purchased new from the Waco factory by present owner. Guaranteed total time 417 hours; engine completely majored 86 hours back. New plane condition throughout; steel propeller and speed ring. Licensed until June 15, 1937. For quick sale, $1,575. Oliver M. Huff, Glade Spring, Virginia.

WACO A WARNER 125: Hand rubbed finish, vermilion, silver wings. Full equipment, including air starter, collector speed ring and airspeed indicator. Never cracked. Time, 140 hours, 30 hours since factory top. Price $2,000, cash only. Parkersburg Flying Service, Parkersburg, West Virginia.

FOR SALE: Waco 9, completely rebuilt; new wings, new covering, new prop; all tubing cleaned to the metal and painted. Motor overhauled. Millerized. Plane balances perfectly and is in A-1 condition throughout. Licensed June 30, 1937. $600. M. Vandegrift, 910 Freeborn St., Austin, Minnesota.

OXX-6 GXE WACO: Air wheels and other extras. Licensed and in A-1 condition. Finished in yellow and black. Will sell cheap. Maurice Giffin, Walhonding, Ohio.

WACO GXE: OX-5, late series. New Goodyear Airwheels. Miller; duals. Licensed. A-1 condition. Or trade for side-by-side ship. Price $550. Tinsley Smith, 1227 Broad, Nashville, Tennessee.

PRICED FOR QUICK SALE: One Model C 4-place cabin Waco, Jacobs-powered. Total time 250 hours; 20 hours since major overhaul. Price, $3,000. W. H. Fallen, 1408 Ninth Avenue South, Fargo, North Dakota.

WARNER WACO F: Motor recently majored, plane recovered; fully equipped. $1,375. Waco C, model 165, $1,800. Waco C, 210 Continental, $2,750. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

THREE 1935 WACO Custom Cabins: Beautiful jobs, with many extras. In perfect condition. You owe it to yourself to see them before you buy. Write for details. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

WACO F. KINNER B-5: Five new heads, Heywood starter; black with red wings; relicensed April; 450 hours; $1,625. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO 10: OX-5, Millerized; new carburetor, duals. Red fuselage, silver wings. Extras. Licensed. A. H. Meyers, 11140 Third St., Romulus, Michigan.

WACO 1935 CUC Model: 285 h.p. Wright; total time on airplane 120 hours, 80 hours on engine. Looks exactly like new. Carries following extras: Hamilton controllable prop, thermocouple, air speed, Kollsman compass, Kollsman sensitive altimeter, rate of climb, Lear radio compass, chronoflite, leather upholstery. Bargain at $6,500. Beech Aircraft Company, Wichita, Kansas.

WACO CABIN: Jacobs 225. 398 hours total time; late 1934 ship, no time on engine since major and modernized as 1936 engine; special rubbed finish, vermilion trimmed in black and gold; pants, air brakes, starter, generator, landing lights, flares, 70 gas, clock. Excellent condition. $3,750. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO J-5 Straightwing: Less engine and propeller; total time since new, 80; no time since completely recovered and finished; wings and fuselage Stearman vermilion, black stripe. New motor mount complete; new landing gear; brakes, wheels, tires and tubes; never cracked. Total time certified. Have pleasure of owning airplane, which is practically new. Price, $1,000 Waco J6-5 Straightwing: Just re-licensed, less than 100 hours since overhauled; engine ring, mail type windshield; vermilion fuselage, just refinished, cream wings; price, $1,100. Wanted: J-5 engine and prop; complete engine cowling and oil tank for Waco Straightwing BSO. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO F: Hours, 480. Latest heavy-duty Kinner 125, steel prop, ring, Irvin chute; complete banner outfit, all letters and night neon detachable sign. Nearby operator can have profitable contracts. Too busy to correspond. Nite phone Bob Trader, Homestead 0214, Pittsburgh, Pennsylvania.

WACO MODEL UKC: 4-place, Continental, total time on plane 366 hours, 80 since motor major at factory. Plane has never been damaged. Looks exactly like new. Extras: Starter, steel prop, flares, landing lights, air brakes, bank and turn, rate of climb, two-band Lear radio, leather upholstery. Bargain at $3,500. The Beech Aircraft Company, Wichita, Kansas.

WACO F KINNER B-5: Five new type heads; 200 hours since major; 10 hours since top, with new rings; black and orange. Always hangared. $1,275. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

1935 JACOBS WACO: Standard cabin, five-place, licensed to 3-37; 197 hours, like new. Priced for quick sale. Terms to responsible parties. Will consider trade. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

WILL SELL WACO F: Warner powered, standard instruments, plus airspeed, bank and turn; perfect condition; $1,395. Also late Waco Cabin, 210 Continental; 275 hours on motor. Standard instruments plus bank and turn, steel propeller, rate of climb, radio; vermilion hand-rubbed finish, perfect condition throughout; $2,285. Inquire Stoner Manufacturing Corp., Aurora, Illinois.

WACO MODEL 1934 four-place Jacobs 225 h.p., total time on plane 284 hours. Extras: Landing lights, flares, two-band Lear radio, rate of climb, bank and turn. Excellent buy. Price, $3,500. The Beech Aircraft Company, Wichita, Kansas.

WACO TEN: Tank powered. Steel propeller, full air-wheels, fabric excellent; just relicensed. An air-cooled job at a real bargain price. Trade or terms. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

Miscellaneous Aircraft

Aeronca, American Eagle, Aristocrat, Avian, Barling, Bird, Boeing, Buhl, Cessna, Cub, Curtiss Robin, Detroit Aircat, Detroit Gull, Eaglet, Fairchild, Fleet, Fokker, Ford, GeeBee, Great Lakes, Howard, Kinner, Laird, Monocoupe, Monoprep, Moth, Pitcairn, Pitcairn Autogiro, Rearwin, Ryan, Stearman, Stinson, Swallow, Taylor Chummy, Travel Air, Verville, Waco.

REARWIN JR.: Aeromarine 50 h.p. motor, recently majored. $650. Barling NB-3, LeBlond 65 h.p., $400. Will trade and finance ships taken in trade on new Taylor Cubs. Gary Airport, Gary, Indiana.

WACO CSO: Wright J6-7; 10 hours since major overhaul; like new; blue and yellow; total 436 hours, $1,800. Kinner Bird, 100 h.p., perfect condition; total 425 hours, $1,100. Knox-Flite, Inc., Knoxville, Tenn.

RYAN B-1, J-5; Velie Monoprep; Eaglet. All ships priced for quick sale; must be seen to be appreciated. DeVoe Airplane Co., Fond du Lac, Wis.

TWO RACING PLANES; one J-5 4000 Travel Air, equipped for skywriting; Cirrus racer, $800; Howard 'Ike', $1,200; Travel Air, $1,175. Harold Neumann, 3000 Tracy, Richardson Apartment, Kansas City, Missouri.

AERONCA MASTER C-3: Perfect, licensed July 1937. 175 hours total. Oleo, enclosure. Privately owned, always hangared. $995. Hisso E. Swallow: 3POLB, licensed, J-5 steel prop, booster, $375. Curtiss Robin OX-5: Licensed June 1937. New linen, prop, tires. Cash or trade. Liming Flying Service, Ravenrock Airport, Portsmouth, Ohio.

WACO F: Kinner B-5, $1,275. Travel Air 4000, Warner 125, $875. Verville Trainer, Continental A-70 165 h.p., $1,150. Planes licensed and in perfect condition. Heywood starter for Warner and J6-5, $50 each. One pair 7.50 x 10 Autofan wheels with brakes and tires, $50. Velie motor, $125. Continental A-70, 165 h.p., $275. Chappell Flying Service, 1245 Liddesdale, Detroit, Michigan.

TAYLOR CUB: Same as new; winter enclosure, compass; best buy of Summer. Three-place Kinner American Eagle, licensed February 1937, recovered, 7 hours on motor since major overhauled. A bargain. Henry Hearts, 318 Sherman Street, Little Rock, Arkansas.

AMERICAN EAGLE OX: Overhauled and ready to license, $300. Davis, Kinner K-5, perfect shape, $1,000. Fleet parts; lower wing assemblies, covered, 60% off factory prices. Stevenson-Weeks Air Service, Municipal Airport, Kansas City, Missouri.

REPOSSESSED TAYLOR CUB: A-40-3 Continental powered, 40 hours; $1,125; $200 down. Taylor Cub A-40-3 Continental powered, 125 hours, $1000; $200 down. Pitcairn Kinner B-5 Autogiro, $1,500, $400 down. Buhl Pup, $500; $100 down. Avian Cirrus Mark III biplane, $650; $150 down. American Eagle OX-5 biplane, $350; $100 down. Balance on above ships in small equal monthly payments. Wired deposit advised to hold if interested. Large choice late model repossessed cars and trucks, which will trade for licensed planes of any manufacture. Aviation Finance Co., Hemlock, New York.

DH GIPSY MOTH: Air wheels, air speed, compass, new cover, license, $875. Taylor Cub, 1935 Continental A-40-3, like new, $1,000. Can finance above ships. Taylor Chummy, Kinner motor, licensed, $600. Brockenbrough, Lumberton, North Carolina.

J-5 TRAVEL AIR: Recovered. Monocoupe, 145 Warner, 300 hours, like new. Stinson S, excellent condition. J6-5 Aristocrat. Warner Waco. Air Activities Airport, West Chicago, Illinois.

PIONEER OFFERS largest selection of used airplanes in United States, at no additional cost to you. State your needs or send for list. Terms arranged. Pioneer Aviation Co., Airport, Syracuse, New York.

SALE OR EXCHANGE: 14 certified airplanes. J-5 Cessna cabin ship. J-5 Speedwing Travel Air. J-6 B-5 6-place Ryan cabin ship. J6-9 330 h.p. Travel Air cabin ship, airwheels. Two Type 2000 OX-5 Travel Airs. One OX-5 Laird. One B-5 125 h.p. Waco, air starter. Two J6-9 Pitcairns, with or without motors, many extras. Two OX-5 Waco 90's. One J-5 B-1 Ryan, 5-place cabin ship. One J6-9 Stinson, airwheels. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

1936 TAYLOR CUB: 2 months old, 35 hours total time, $1,195. Gee Bee, Kinner K-5: 45 hours since overhaul, $875. Avian Cirrus, $600. Also Great Lakes, Birds, Cessnas, Monocoupes. Munch & Romeo, Inc., Hangar 7, Roosevelt Field, Mineola, New York.

FOR SALE OR TRADE: KR-34 with J6-5, brakes and tail wheel, semi-balloon tires. Fairchild 71, Wasp, air wheels and tail wheel. Fleet Trainer, K-5 Kinner, air wheels. All ships in good condition. One Kwikway multi-purpose grinder, like new. Two parachutes. Write or wire J. L. Steward, Municipal Airport, Akron, Ohio.

1934 RELIANT STINSON: Like new, fully equipped. J6-5 Travel Air, perfect shape. Warner Waco F, clean, just relicensed. J6-5 Robin, 350 hours since new. Velie Monocoupe, 32 ft. wing, latest model. These ships are ready to go and priced right. Burnham-Miller Flying Service, Municipal Airport, Omaha, Nebraska.

WARNER CESSNA, Warner Waco F, American Cirrus engine parts, new. Special camshaft with roller followers for inverted Cirrus. Type PCV Aerol struts. Write for information. AERO DIGEST, Box 2350.

WACO CABIN: Continental; on floats or wheels. Kinner low-wing; Wasp Stearman; J-5 Ford Trimotor; Avro Avian, American Moth; others. Chuck O'Connor, Airport, Westfield, Mass.

FORD 5-ATC: Excellent condition. Used on airline exclusively. Bargain price. Fokker F-10A, good condition; with or without motors; make offer. Stearman C3R, Wright J6-7; wonderful condition; fully equipped, landing lights, radio, two sets instruments. Boeing 40-B-4, fine condition; fully equipped; skiis if desired; make offer. Airplane parts: Ford, Stearman, Lockheed, Boeing. Supplies and aircraft hardware, all kinds. Engines and parts: Wasp B and C motors, overhauled or "as is". New and used parts. Instruments: Gyros, sensitive altimeters, all other instruments; new, used. Radio: Aircraft receivers, dynamotors, supplies. Write or wire Hanford Tri-State Airlines. Sioux City, Iowa.

WARNER WACO F: Starter, $1,500. Accept car, ship on trade. Cracked F, $650. Bird, $250. Fleet, $250. Want parts for ships. Kinner, $200; Warner, $450; J-5 $275; parts reasonable. Will buy airplanes, motors, parts. Swedler Aircraft, 816 Ontario Street, Toledo, Ohio.

BEST BUYS ON PAGE, less motors: B-1 5-place Ryan cabin ship, full airwheels. J6-9 6-place Travel Air cabin ship. These ships all NC licensed and priced to sell. Michigan Aero Motors, Jackson, Michigan.

B-5 RYAN MONOPLANE: Cabin, J6-9 Wright Whirlwind; on Edo pontoons, but with land gear also. Licensed till October, 1936. Plane and motor completely overhauled. Motor flown 3 hours since major. Wings cream, fuselage vermilion, pontoons and gear silver. Total time 1,000 hours. Detroit Gull glider, new, for primary and secondary training. Fleet fuselage with tail group, landing gear, ailerons, struts, gas and oil tanks, as good as new. AERO DIGEST, Box 2351.

FOR SALE: Detroit AirCat, LeBlond motor, 60 h.p., approximately 150 hours, 10 hours since top overhaul, $75. Also two Scintilla magnetos for LeBlond, $35. Roy Williams, 2816 East Market Street, Warren, Ohio.

ENGINES

Cirrus, Curtiss, Kinner, Lycoming, Tank, Velie, Warner, Wright

VELIE MOTOR: Never flown since complete major overhaul. Like new. Best offer takes motor. Wm. J. Schulte, El Reno, Oklahoma.

J-5 MOTOR: Complete, like new. Warner 110, just overhauled, $250. OX-5 motors and parts. Command-Aire wings, fuselage, landing gear, all parts. Brockenbrough, Lumberton, North Carolina.

J6-7E: No time since top overhaul by Wright Station. Complete and reasonably priced. Warner 125: 575 hours total, three since major, $450. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

KINNER B-5: Curtiss-Reed propeller; Heywood starter; 314 hours, 41 hours since major, $550. New Cirrus, $275. Used Cirrus, $75. 6.50-10 wheels, brakes, tires, tubes, $50. Tred Avon Flying Service, Easton, Maryland.

ENGLISH CIRRUS: Mark III, Upright. 95 h.p. Complete in original crate with tools. Never used, $275. N. W. Perdew, Hasbrouck Heights, New Jersey.

LYCOMING MOTOR: R-680. Completely modernized and majored by air lines. Transport shaft, forged pistons, starter shielded box; make cash offer. Leeward Flying Service, New Kensington, Pennsylvania.

BARGAIN: Model 63 Tank 115 h.p. motor, recently majored and ready for installation. Central Air Service, Grand Rapids, Michigan.

AIRCRAFT ENGINES: New and used LeBlond, Szekely, Kinner, etc. Parts and accessories. Aircraft parts manufactured to order. Aircraft Development Co., 1530 Olive St., N. E., Washington, D. C.

ONE J-5 MOTOR: Complete, running condition, $200. Leech Aircraft, Inc., Roosevelt Field, Mineola, New York.

PARACHUTES FOR SALE

PARACHUTES: Approved types. Used, $60 up. Navy surplus, 18 ft. white silk chutes. like new, $4 each, prepaid. No COD's for one. Wanted: 100 parachutes, any condition; we can use the salvage. Outstanding air thrillers for airports, celebrations, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

TWO EXCELLENT 24-foot seat packs, pure white Japanese silk Russell parachutes. Quick sale, $60 each. Shipped unpacked for your inspection. Michigan Aero Motors, Jackson, Michigan.

WANTED TO BUY OR TRADE

WANTED: Used Menasco 6 motor and prop, or Ranger 6 motor and prop. J. M. Strong, 6164 Field, Detroit, Michigan.

WANTED: Velie Monoprep, oleo gear, or similar ship. No junk. Will pay cash. Al Curran, 27 Leland Street, Malden, Massachusetts.

WANTED: Airplane parts and supplies. Lycoming, Wasp, Wasp Junior engines and parts. Tools and shop equipment. T A C A, Tegucigalpa, Honduras, Central America.

WANTED: Warner Fairchild 24, '35 or '36; list all equipment, hours and price in first letter. AERO DIGEST, Box 2336.

WANTED: Wright J-6 engines or parts, any series. Also Pratt-Whitney engines and parts, any series. We also buy propellers, instruments, air wheels. Babb, 1044 Airway, Glendale, California.

WANTED AT ONCE: Right and left lower wings for long-nose American Eagle Model 129, covered or uncovered. Must be licenseable condition. Airport, Bristol, Virginia.

WANTED: Landing gear for Travel Air 2000 Model, also hand turning starter for J-5 Wright motor. Frank Reimers, 314 No. Fourth St., Lafayette, Indiana.

WANTED: Szekely SR-3-0, 45 h.p., or Salmson 9-cylinder 40 h.p. Give complete description, serial number and lowest cash price, first letter. Alfred Quinby, High St., Closter, New Jersey.

WANTED: Licensed utility glider or utility glider kit. Give full description and lowest price acceptable in first letter. Write E. N. Young, 1314 11th St., N. W., Washington, D. C.

WANTED: Lockheed Vega hydraulic shock struts (short). Three one-minute International pistol flares. OX-5 Travel Air in good condition. Stanley G. Fuller, Milford, Iowa.

WANTED: Licensable left lower and upper wing panels for S-2000 Travel Air; covered or uncovered. Give details and lowest price in first letter. Lester Frenz, 2465 N. 47th St., Milwaukee, Wisconsin.

WANTED TO RENT: Airport, hangar, living accommodations, in South, near city. AERO DIGEST, Box 2341.

WANTED: Model 2 Fleet wings with struts and fittings. One set of 22-10-4 brake wheels and tires. Concord Air Service, Concord, New Hampshire.

SPOT CASH paid for your airplane, motors and parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WANTED FOR CASH: New or good used Challenger engine, Challenger crankshaft, heavy type crankcase nose section, pistons and rings and valve-seat refacing tools. Also good J-5 and motor mount for Fledgling. W. R. Beeler, New Albany, Indiana.

RIGHT WING WANTED for 71 Fairchild and struts for same. Also wheel. Roy M. Hall, 401 Brickell Point, Miami, Florida.

WANTED: Three J-5 crankshafts, air wheels with brakes, any size; steel propellers and instruments. Central Air Service, Grand Rapids, Michigan.

WANTED: Genet engine, any condition, except cylinders must be good. Renfro Airport, Hereford, Texas.

WANTED: One Kinner B-5 125 h.p. cylinder head. Walter Kemp, Westchester Aircraft Parts & Service, Bedford State Road, Armonk, New York.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

BROTHER, CAN YOU SPARE A DIME? If you can, send it to me and I'll send you my 1936 Low-Priced Aviation Material Catalog. (Canada 20¢). Karl Ort, 625 W. Poplar, York, Pennsylvania.

FOR SALE OR TRADE: One slightly used Eastman K-5 aerial camera with mount for oblique pictures. Can also be used for vertical pictures. Used only one month. Cost new over $900. AERO DIGEST, Box 2335.

35 GALLON WACO GAS tanks, spars, fittings, Sperry artificial horizon, and Sperry directional gyro. John Lawless, 31 Coffey Street, Brooklyn, New York.

STANDARD D-25 PARTS: Upper and lower wings, flippers, stabilizers, ailerons, wood propeller, propeller hubs, center section and tanks, oleo landing, J-5 motor mount, cowling, struts, vertical fin, fuselage complete and all fittings for wings and wires. Brockenbrough, Lumberton, North Carolina.

FLEET: Modernized K-5, 60 hours since major overhaul, complete recovery; total 500 hours. Full airwheels, standard instruments, relicensed June 10th. $1,350. Waco F, K-5, just relicensed, $1,300. LeBlond Engine. New Scintilla 5-cylinder magneto in factory case. Russell Lobe parachute. Air speed, tachometer, turn-bank, rate climb, altimeter, sensitive altimeter, compass, ball-bank, air temperature gauge. Best offers accepted. H. C. Holtz, 3454 No. Frederick Avenue, Milwaukee, Wisconsin.

SPECIAL: Pioneer 103-C turn indicators; with venturi, six months' guarantee, $35. Write for new 1936 catalogue of aviation supplies. Snyder Aircraft Company, Municipal Airport, Chicago, Illinois.

PROPELLERS: Standard Steel, reconditioned, J-5, J-6, Lycoming, Challenger, Wasp Jr.; hubs and blades for test purposes; J-5 and J-6 cylinders, magnetos and carburetors; J-6 and Wasp hand inertia starters. General Airmotive Corp., Municipal Airport, Cleveland, Ohio.

PORTABLE HANGAR: Prefabricated wood and metal. Set it up yourself in a couple of days. The answer to low cost storage. $9.59 monthly. No down payment. Bennett Air Service, National Distributors, Hightstown, New Jersey.

WIND TEE: Automatic, complete with lights and all accessories, $125. Cost new, $1,550. Rising Sun Aircraft School, 857-67 East Luzerne St., Philadelphia, Pennsylvania.

SIKORSKY S-38 AMPHIBION: Disassembled. Never crashed. Will sell complete or parts for repairs from same. Owners file this ad for future reference. Aviation Finance Co., Hemlock, New York.

AIRPLANE PARTS: 2000 Travel Air; Travel Air 12-Q; Waco 10; Waco Cabin; Great Lakes; J-5 Travel Air motor mount and oil tank. Kingsville Cabinet Shop, Kingsville, Missouri.

CHALLENGER KR-31 PARTS: Fuselage, wings, struts and tail surface. Rising Sun Airport, Inc., 851 East Luzerne St., Philadelphia, Pennsylvania.

WARNER 125 H.P. Hamilton propeller, reconditioned, $100, complete. Eclipse direct electric starters for Lycoming, Jacobs, J-5, etc., $75. Hand inertia for same, $20. New 15v-15a generators with control boxes, $40. Moth upper panels, covered and in A-1 shape, $35. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

AIRWHEELS: 22 x 10 x 4, with brakes and all fittings, $50. Also pair wheel pants for 750 x 10 tires, $20. Rising Sun Aircraft School, Inc., 857-67 East Luzerne St., Philadelphia, Pennsylvania.

SALE: "Simple Aerodynamics," $3.95. "Principles of Flight," $4.95. "Engineering Aerodynamics," $5.95. "Aviation Handbook," $6.95. "Introduction to Mechanics and Heat," $2.50. "General Engineering Handbook," $3.50. "Practical Calculus for Home Study," $2.50. Six-place tables, $1.00. All perfect, brand new; all for $30. G. J. Adams, 2411 - 14th Avenue, Sheffield, Alabama.

PORTABLE STEEL HANGAR: Rust proof, galvanized and silver-painted. Description: 52 x 80 x 12 with leanto 14 x 80 x 8; round roof, 2-inch wood floor, stock room, instruction room, office and two rest rooms; on both sides, inside sliding doors; suitable for water and land operations; floodlights on front and rear; own water system, electric fixtures. Make reasonable offer either as a unit or separate. Photos to interested party. AERO DIGEST, Box 2352.

TWO SETS of military Waco wings, originally intended for the Brazilian Government. Charles Koster, 483 Fourteenth Street, Brooklyn, New York.

SPERRY HORIZON, directional gyro, overhauled and recalibrated, $160 each. Latest horizon and directional gyro, with lights, $230 each. Turn and bank, $45. All perfect, guaranteed. AERO DIGEST, Box 2346.

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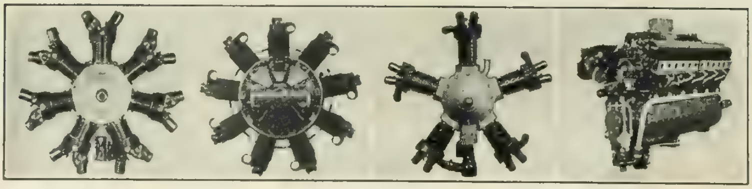

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Among the engines dealt with are: Pratt & Whitney Wasp, Wasp Junior, Hornet; Wright Whirlwind, Cyclone; Curtiss D-12, Conqueror, Challenger; Lycoming; Packard-Diesel; Warner-Scarab; Kinner; LeBlond; Continental; Liberty. **Equipment covered includes:** Scintilla Magnetos, Types AG and V-AG, Double Magneto Type SC, N Series; Eclipse and Leece-Neville Electric Generating Systems; Delco Battery-Generator Ignition System; Eclipse Engine Starters; Zenith and Stromberg Carburetors; Superchargers; Cooling and Lubricating Systems, etc., etc.

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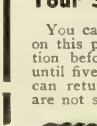
Airplane Mechanics Rigging Handbook

by R. S. Hartz, *formerly Lieut. Colonel, Air Corps, U. S. Army; and* **Lieut. E. E. Hall,** *formerly Editor, "Aircraft Servicing." 104 illustrations.* **$3.50.**



This book covers in detail the care and handling of airplanes on the ground and in the shop; sequence of rigging steps; how to true up the assembled ship; how to adjust the wings and control surfaces for "hands off" flying; spars and struts; inspection; installing and checking compasses; fabric; wood and glue; metal parts; wire; dopes and doping; folding and packing parachutes. It shows you how to get a plane into proper flying condition and how to keep it that way.

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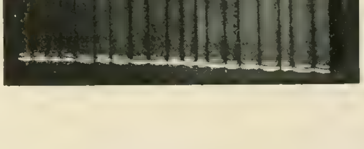
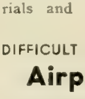


INTRODUCTION TO AERO ENGINEERING:

Simple Aerodynamics

4th Revised Edition by Colonel C. C. Carter, *U. S. Military Academy, West Point, 395 illustrations.* **$4.50.**



This famous textbook is used by the Army cadets at West Point and by students in over 100 leading technical schools, colleges, and flying schools.

It provides a clear and easily understood explanation of the fundamental aerodynamics involved in the design and operation of the airplane. It shows, for example, how to make the necessary calculations to estimate the performance of a particular plane under various conditions.

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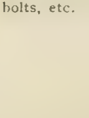

How to make the calculations in the stress analysis required by the Department of Commerce. Each point is explained with the utmost clearness; advanced mathematics has been avoided as far as possible. Explains principles of applied mechanics involved. Takes as an illustration an average airplane and gives full examples of all computations required. Includes tables giving vast amount of stress data, covering steel, wood, tubing, hard wire, steel cable, tie-rods, rivets, bolts, etc.

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AERO DIGEST, August, 1936
Volume 29 Number 2

Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.

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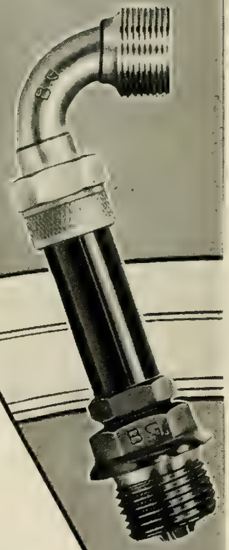

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The Birdmen's Perch

After flying through this page "on the instruments," fellows—how about sharpening an old valve stem, and sending us a bit of news about yourself or your friends? We thrive on red-hot exhaust stack gossip. Direct your correspondence to

"Tattered Wing Tips," alias AL WILLIAMS
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

SOMETHING TO CHEW OVER

"Several weeks ago, a tourist arriving in Miami discovered he had left one of life's little necessities in a Nassau hotel. He wired the hotel, and a few hours later a small package was delivered to him by air. The tiny parcel contained a false tooth. The tooth, and nothing but the tooth, so help me."
—W. N.

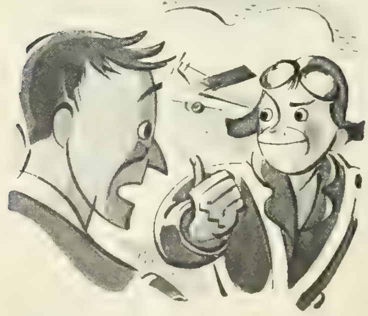
HOT AIR MAN

"At Oakland airport, several years back, there was a lad who figured he was God's gift to aviation. His cocky attitude used to burn one of the inspectors up.

"When the lad came up for his pilot's license, he drew the grouchy inspector. After going through the necessary paces (and a few unnecessary ones) the tyro taxied in.

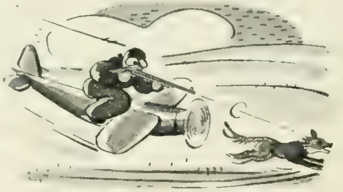
"As the ground hogs drew around, the youngster bounced out and yelled, 'How'd I do, old timer?'

" 'Great, boy, just great,' the inspector snapped. 'Outside of a rotten take-off, too fast a climb, drifting on the turns, skidding on the spirals, landing with one wing low and undershooting the mark, you just bowled me over with the way you handled that ship.'

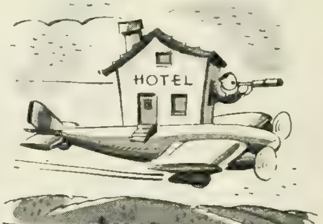


"But the boy wasn't bothered. He immediately piped back, 'Well, old knobs, did I climb out of the plane okay?' Doubt me if you will, but he got his license!"
—B. N.

DID YOU KNOW?



"That a pilot in Wyoming makes a mighty good living hunting coyotes by plane."
—H. B. L.



"That a wooden hotel was carried fifty miles by plane in New Guinea . . . from a mountain lumber camp to a town on the coast."
—W. K.

That Gulfpride Oil is made from selected 100% Pennsylvania crudes. Then carried a long step further by Gulf's exclusive Alchlor-process. Result—a super oil that forms only 1/5 to 1/3 as much carbon as other Pennsylvanias.

James McCrackle Montgomery Swogg
Had the world's most famous Jumping Frog.

While Hector Hannibal Henry McGeek
Had a frog that was pale and puny and weak.

The husky frog was "Danville Dread"
And the puny frog was just called Fred.

'Twas the day of the Annual Frog Jump Meet
And the Danville Dread cleared thirty feet!

The crowd went wild and yelled "By, Gee!
That's the greatest jump in history!"

And they all just booed when McGeek came up
With his hopeless frog and an old tin cup.

Alas! Poor Fred seemed quite done in
Till he took a drink from the cup of tin.

Then he cocked his eyes and raised his head
And he gave a croak that woke the dead.

He licked his lips and thumped his chest
And flexed his legs for the mighty test.

With a giant jump, he *soared* away
And didn't land till a year from May.

They brought him back in a private train
And drank his health with French champagne.

But Fred just croaked for his old tin cup
With the good old drink that pepped him up.

You know the 'drink', it heads the class.
It's good Gulf Aviation Gas.
—F. Z.

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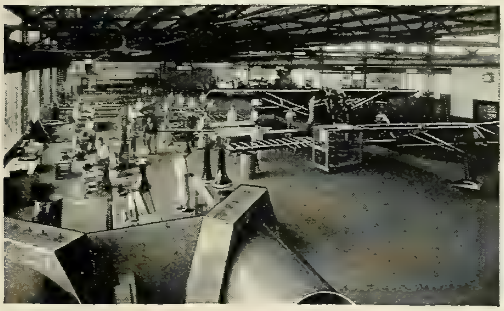

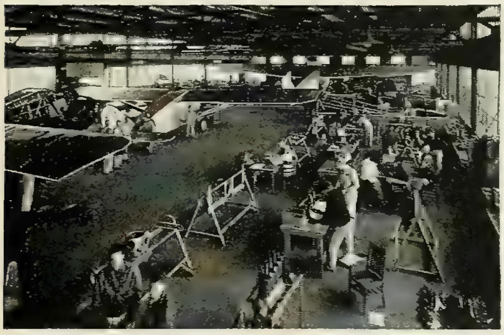

These pictures of each half of the PARKS AIR COLLEGE Airplane and Engine Mechanics School were taken from the top of the wind tunnel which is located at one side near the center.

They indicate the extent and completeness of facilities which are typical of each of the four schools of PARKS AIR COLLEGE.

It is because of these extensive facilities that comprehensive courses, each requiring 96 weeks for completion, can be offered to those who realize that more than a few weeks or a few months are necessary to secure adequate training—training which will develop the superior knowledge and skill to place the graduate ahead of competition and enable him to win the race for the coveted position in aviation.

It is from PARKS AIR COLLEGE that graduates have gone to take their places with air line operators and manufacturers in all parts of the World. These graduates have so proven their worth that executives, keenly alive to the fact that future expansion will require a large number of high calibre men, keep asking for more graduates, often more than are available.

If you want to enter aviation and if you are much in earnest in your purpose to climb above the average, then you, too, will be welcome at PARKS AIR COLLEGE.

EVERY MEMBER OF THE SPRING TERM CLASS IS OFFERED A POSITION BEFORE HE RECEIVES HIS DIPLOMA

Wednesday, June 17th, the President of PARKS AIR COLLEGE announced by air mail to only two aviation operators that two days later the Spring term class would be graduating. He recommended to each the graduates he believed would fit well into the respective organizations.

The response was immediate. Before noon Friday, in fact before the graduates had received their diplomas, *every one* had been offered the position for which he had been recommended. Then other telegrams arrived asking for still more graduates.

This ready response was not surprising. Instead, it was expected. For in the past 18 months 137 graduates have made excellent connections. They have gone to the strongest companies in the industry where competent personnel is recognized as the most important factor in aviation's development.

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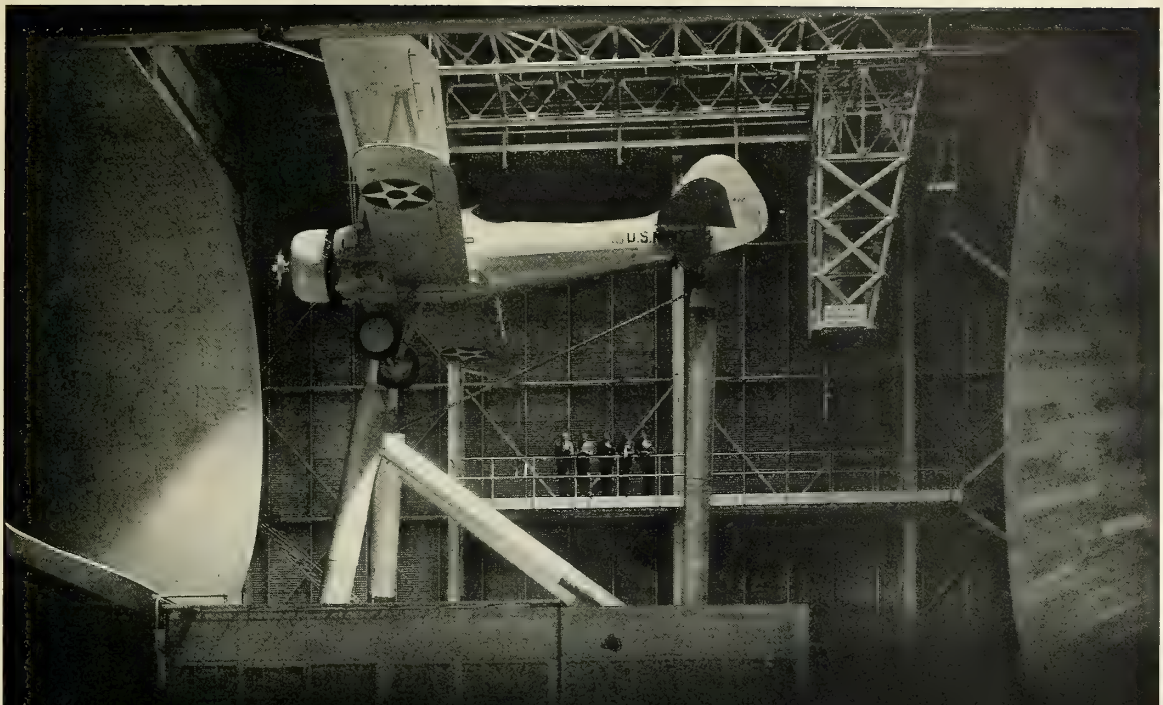

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July 5, 1936

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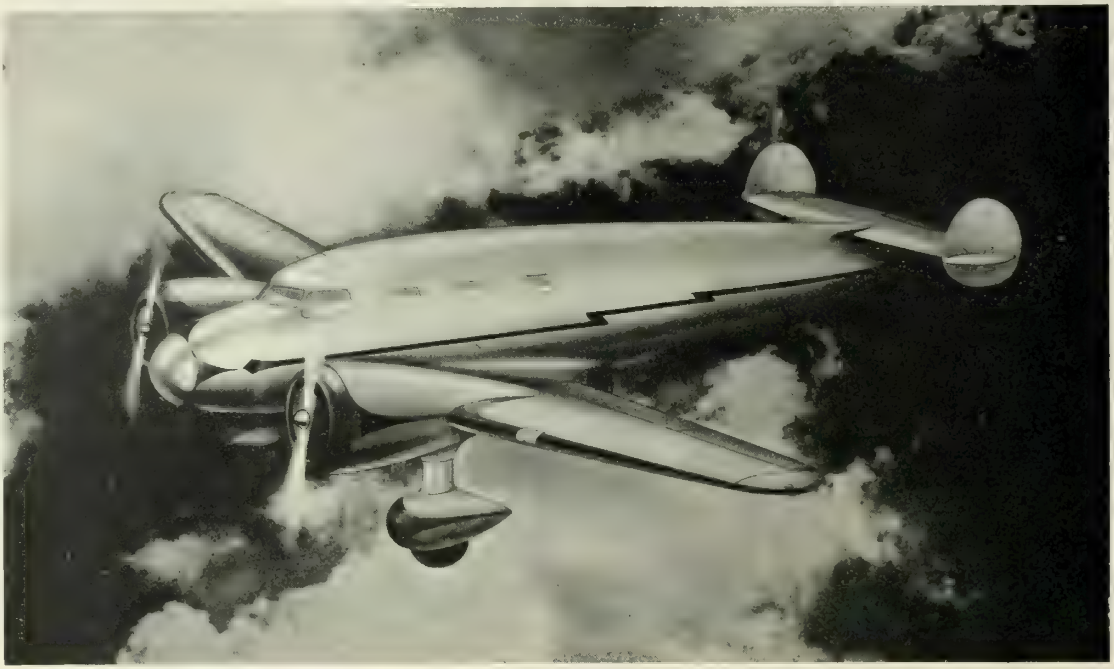
A. D. August, 1936



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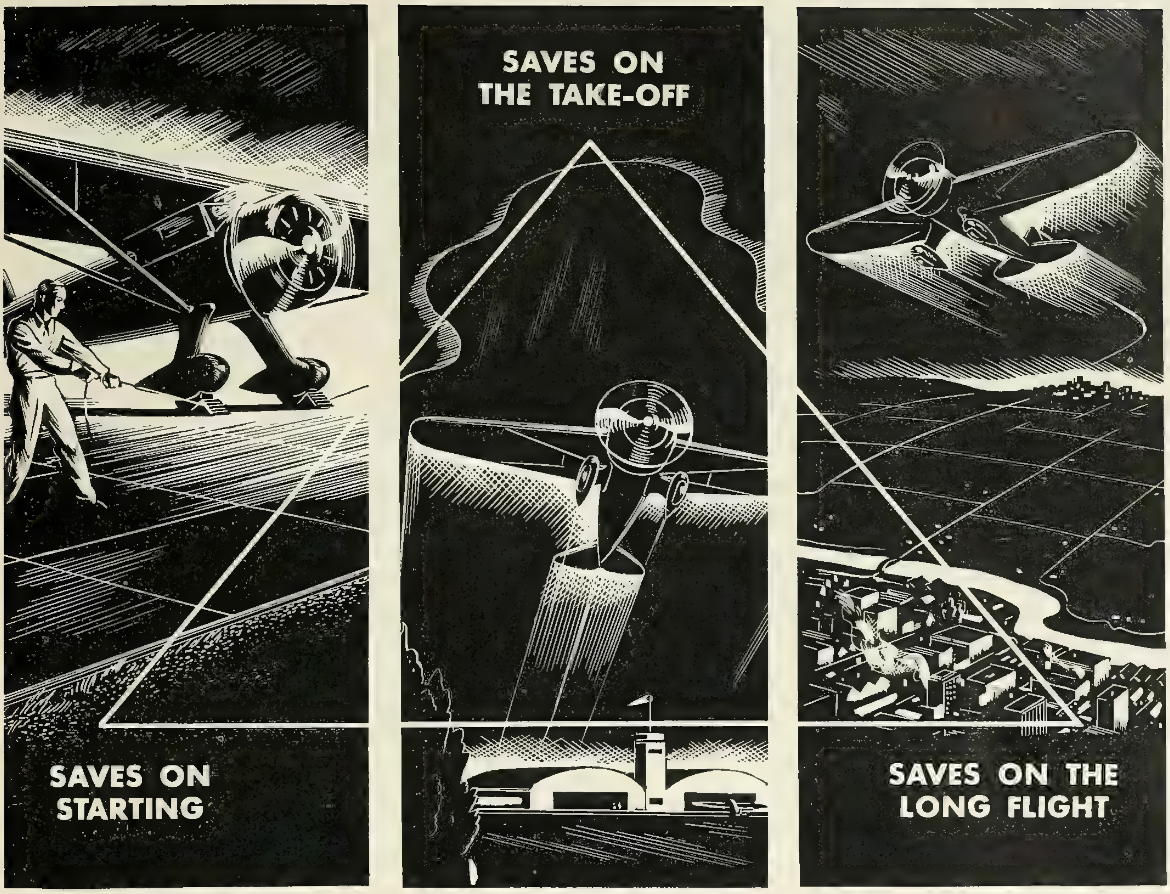

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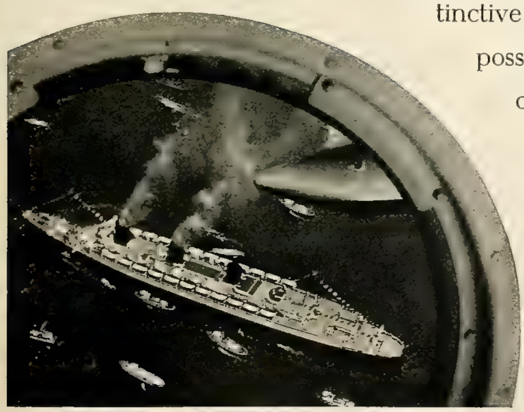
A porthole view from the S-43 as the Queen Mary steams up New York Harbor.



Sikorsky Aircraft

Bridgeport, Connecticut
Division of
United Aircraft Corporation

RYAN

School of Aeronautics

Above—Peter Dana, 20 year old Ryan transport graduate who, on July 18, 1936 in his standard 125 h.p. Ryan S-T*, flew from San Diego to New York and established a new transcontinental flight record of 22 hours 6 minutes for planes in this classification. One year ago, in the same plane, Dana established the previous transcontinental record of 25 hours 40 minutes and May 22, 1936 he set the present tri-flag mark of 11 hours 6 minutes flying time from Vancouver, B. C. to Tia Juana, Mexico.

HISTORY IS MADE

by young men of Dana's type who have had thorough aeronautical training such as has made Ryan courses a standard of excellence during the sixteen years of the school's operation.

These high Ryan standards are reflected in the confidence which the aircraft industry places in Ryan graduates—and are again reflected in the confidence which each Ryan graduate has in his own ability to do the job for which he has been trained.

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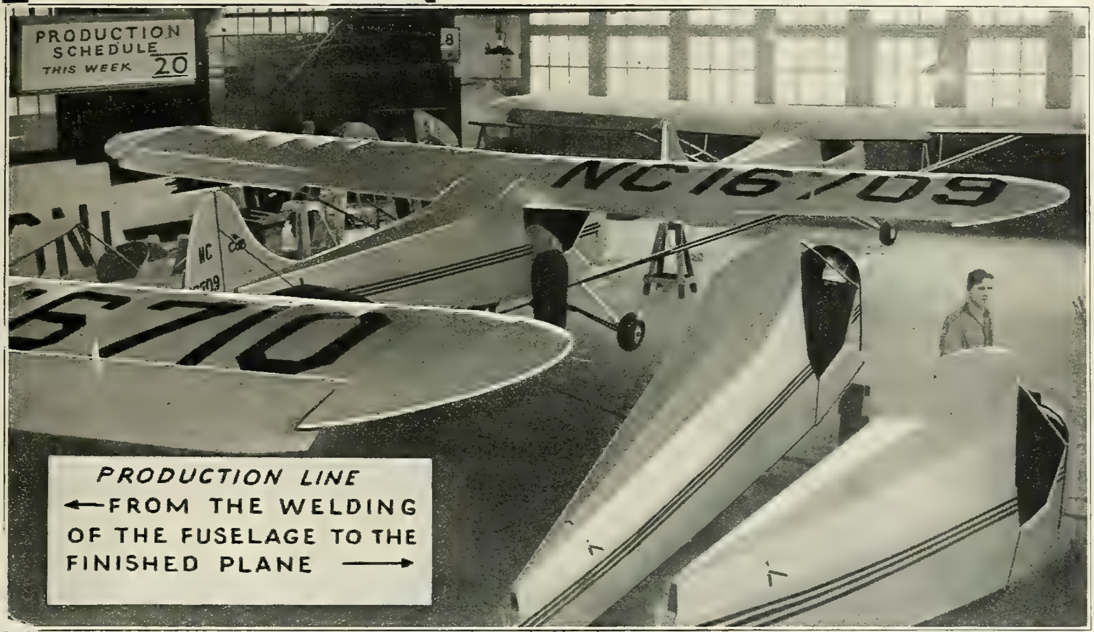
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POPULAR demand did it! Production *had* to be increased. Everybody liked the New CUB from the very first; and from the way orders poured in everybody *wanted* one immediately. (Sales increased over 200% over last year.)

Every effort was made to fill this avalanche of orders but it couldn't be done and maintain the high CUB standard of workmanship. But that has all been changed now.

Anticipating the popularity of the New CUB, ground was broken last winter to double former production capacity. Even that was changed. Construction was stepped up to THREE TIMES former capacity.

Now that construction is completed and operations are functioning smoothly, with 200 men working in shifts, day and night, a steady flow of 20 CUBs pour forth from this highly coordinated plant weekly.

Now you can expect QUICK DELIVERY of your New CUB.

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VOLUME TWENTY-NINE NUMBER TWO

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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone PLaza 3-6969. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5.

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CHICAGO: L. F. McClure, 919 No. Michigan Ave., Ph. Superior 1086.
LOS ANGELES: James C. Galloway, 1129 Mohawk St., Ph. Fitzroy 6332.
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Portland Cement Assn. photo

Primary flight instruction has just begun for 117 new cadets at Randolph Field, San Antonio, Texas. This impressive monolithic concrete administration building is typical of the modern design and construction of buildings comprising the country's finest military training center.

AIR—
HOT AND OTHERWISE

Charges, "Settlement" and Politics

FRANK A. TICHENOR

Tribute to the Roosevelt-Farley Forgotten Men—MacClelland Barclay's design for a bronze in memory of 12 Army pilots sacrificed on the Altar of New Deal politics

● "The Government has settled five suits which have been filed in the Court of Claims by air mail contractors whose contracts were annulled in February 1934." . . .

The above publicity release from the Post Office Department is an admission by President Roosevelt and his Postmaster General that cancellation of air mail contracts was made without cause. It is an admission by Roosevelt and Farley that the constitutional rights of these citizens of the United States were destroyed to serve a political purpose.

It is proof that $3,767,355 of the taxpayers' money was wantonly wasted, but what are millions to billion-dollar boys—none of whom ever actually earned a thousand dollars.

And it is conclusive proof that the murder of the twelve Air Corps pilots should be placed at the doors of the White House and the Post Office Department—and that's that.

Now let's review the cancellations. We will start with Farley's letter to Senator Black:

February 14, 1934.

"Hon. Hugo L. Black
Chairman, Special Committee on Investigation of Air Mail and Ocean Mail Contracts
United States Senate
Washington, D. C.

My dear Senator Black:

"I have issued an order annulling all domestic air mail contracts, and believing that your Committee would be interested in knowing the reasons therefor I submit the following:

"These contracts were annulled only after a most thorough investigation covering a period of several months. Moreover, I had the benefit of the opinion of the Solicitor for this Department, whose conclusions of law were personally examined and approved by the Attorney General.

"I do not believe Congress intended that the air mail appropriation should be expended for the benefit of a few favored corporations. . . .

"I am convinced that before any of the air mail contracts were awarded, those interested held meetings for the purpose of dividing territory and contracts among themselves. Indeed, certain air transport operators who had not been invited to attend were refused admission, when they attempted to gain entrance. . . .

"These meetings resulted in a division of all air mail contracts of the United States and the practical elimination of competitive bidding. A written report embodying the recommendations and an agreement for a division of territory was filed with Postmaster General Brown June 4, 1930. . . .

"It is incontrovertible that the 1930 meeting was held, that it was confined to those who subsequently obtained the contracts, that the provision of law calling for competition in bidding was not carried out, and that all the present domestic air mail carriers secured contracts based on conspiracy or collusion. . . .

"In view of the facts hereto recited and the plain provisions of the law, it was clearly my duty to annul all of these contracts.

Very truly yours,
James A. Farley,
Postmaster General."

Now we have ex-Postmaster Walter Brown's publicity release to the daily press under date of May 19, 1930 referring to the May 20 meeting.

"In order to acquaint themselves with the provisions of the Watres bill recently made a law through the signature of President Hoover, representatives of every large passenger and air mail carrying concern throughout the country conferred today with Postmaster General Brown, Assistant Postmaster General Glover and other officials of the Department in charge of the Air Mail Service. This is the first time that operators of the large passenger lines have had an opportunity to talk with the Postmaster General and exchange views with him since the Watres measure became a law.

"A general discussion of air mail and passenger carrying business, together with prospects for their future development took place at today's meeting. The Postmaster General explained to those who attended the conference the limitations placed on him under the terms of the Watres act, which fixed the maximum that can be paid for carrying the mails to $1.25 a mile and a charge of 40 cents a mile for each passenger transported.

"Before the close of today's session it was agreed that the operators present should prepare a map of the United States, which will show in detail plans for a network of passenger and air mail routes to cover the country and which will be determined at future conferences with the Postmaster General. . . ."

Is this conspiracy or collusion? If the attendance at a meeting called by a member of the Cabinet of the President of the United States constitutes collusion then practically every act of the present administration is tainted with collusion. No president or cabinet has ever called more conferences of its citizens than has Roosevelt and his associates.

In the meeting of May 20 the Postmaster General stated that the air mail map did not provide for coordinated systems and that there were great sections of the United States which were without air mail service. He stated specifically that he had decided to have two new transcontinental routes, one through the Central portion of the country from New York to Los Angeles via Kansas City, and one through the Southern portion, from Los Angeles to Atlanta via El Paso and Dallas. He stated that these transcontinental lines should be independently owned so that the Government would have the benefit of competition in service and would have alternative routes for dispatching the mail under varying weather conditions.

The air transport operators had nothing to do with calling this meeting and were unaware of its purpose until they met with the Postmaster General and his principal assistants in the Post Office Department about May 20, 1930.

This and all subsequent meetings were given the widest publicity in the press of the entire world. Conspirators and collusionists do not publicize their plans, and even Roosevelt and Farley know this.

In commenting on the settlement of

(*Continued on page* 84)

MANUFACTURING FACILITIES
of North American Aviation, Inc.

● Less than 90 days after ground was broken for the new factory which now houses North American Aviation manufacturing activities, the company completed its move from Baltimore, Md. to the Municipal Airport in Los Angeles and started production. The factory is a composite structure of steel and stucco in modern California architectural style, and is designed for economy and efficiency, the layout being planned to include provisions for increasing its capacity quickly and without interference with operations in the present unit.

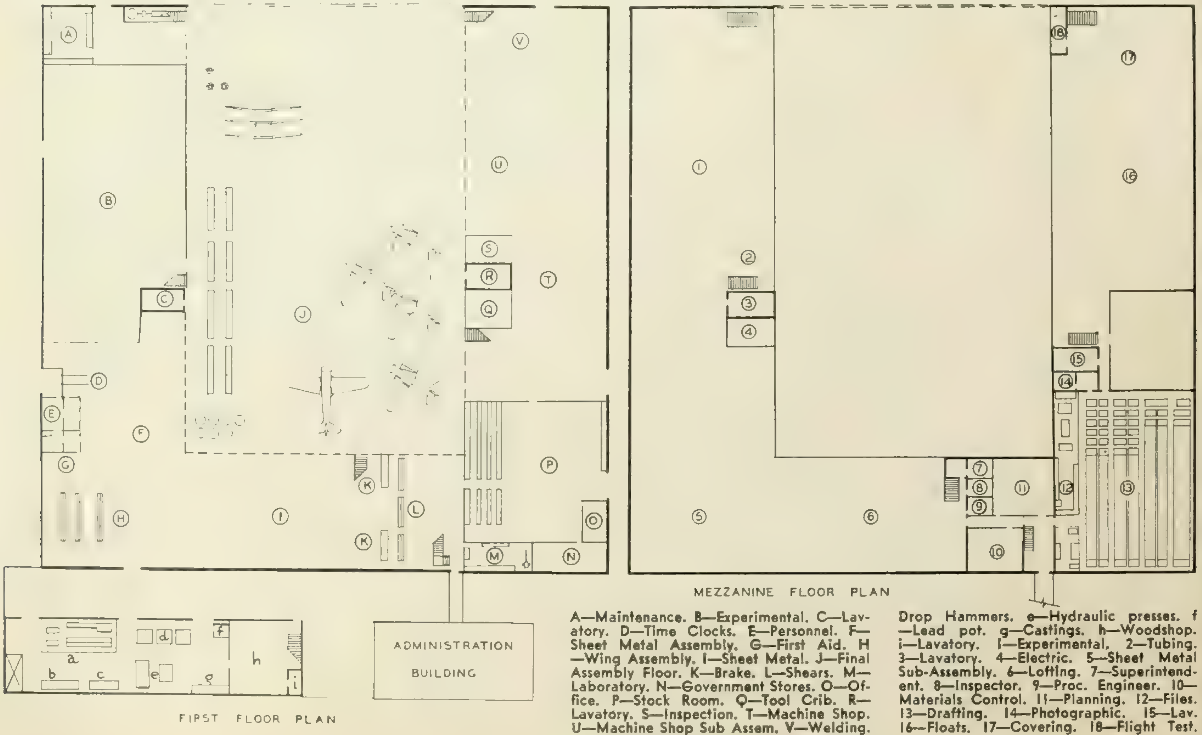
Buildings at present comprise 163,000 sq. ft. on 3.5 acres of a 20-acre tract leased by the company from the city of Los Angeles. Situated directly on the airport, it has the advantage of direct access to runways from factory hangar doors and if necessary additional bays may be added towards the runway and the hangar doors moved out to a new location. The present ramp has been so designed that in the event of expansion it will serve as the floor of the addition.

Directly in front of and separate from the factory is the two-story administration building which contains 7056 sq. ft. of space and is joined to the factory by an overhead ramp from the second floor. General offices, chief engineer's office, technical engineering and Army and Navy representatives' offices are located in this unit.

The main production unit comprises two sections—a main ground floor of 91,240 sq. ft. and a mezzanine of 55,506 sq. ft. (including 7125 sq. ft. of drafting room). Mezzanine type of construction was employed to utilize this extra space for sub-assemblies and working of light parts to save main floor space for large assemblies and heavy work.

Sub-assembly jigs, work benches, and small machines are located on the mezzanine to carry on sub-assemblies. Overhead monorail system gives handling facilities to and from these departments. Layout of the mezzanine places the well-lighted drafting room, planning department, factory superintendent's office, materials control department, and the loft, adjacent to the ramp connecting to the chief engineer's office and technical section. This location presents an efficient method of handling orders and the information required in modern aircraft manufacturing procedure.

The ground floor has a clear assembly area between columns of 150′ × 240′ and 25′ overhead clearance to bottom chord of trusses, thus allowing complete as-



A—Maintenance. B—Experimental. C—Lavatory. D—Time Clocks. E—Personnel. F—Sheet Metal Assembly. G—First Aid. H—Wing Assembly. I—Sheet Metal. J—Final Assembly Floor. K—Brake. L—Shears. M—Laboratory. N—Government Stores. O—Office. P—Stock Room. Q—Tool Crib. R—Lavatory. S—Inspection. T—Machine Shop. U—Machine Shop Sub Assem. V—Welding. a—Anodic. b—Furnace. c—Quench. d—Drop Hammers. e—Hydraulic presses. f—Lead pot. g—Castings. h—Woodshop. i—Lavatory. 1—Experimental. 2—Tubing. 3—Lavatory. 4—Electric. 5—Sheet Metal Sub-Assembly. 6—Lofting. 7—Superintendent. 8—Inspector. 9—Proc. Engineer. 10—Materials Control. 11—Planning. 12—Files. 13—Drafting. 14—Photographic. 15—Lav. 16—Floats. 17—Covering. 18—Flight Test.

Floor plans of the North American Aviation manufacturing plant at Los Angeles Municipal Airport, Inglewood, Calif.

sembly of as large an airplane as is designed at present. Hangar doors provide the same clear exit space to the field. The saw-tooth type of skylight roof and extensive use of glass in side walls provides ample daylight in all parts of the building; both mazda and mercury vapor lighting systems are installed for night work.

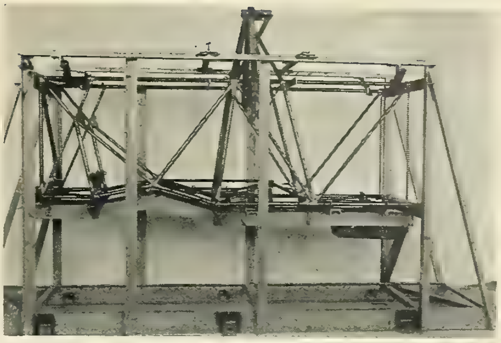
The accompanying floor plan shows the location of the storeroom, machine shop, welding department, sheet metal department, experimental department and main assembly area.

Sheet metal moves from the storeroom to the adjacent shears, brakes, cutting machines, punch presses, etc., where it is cut, shaped and punched according to templates. Next it moves to work benches for fabrication and then to the utility building for processing such as heat treating, anodizing, etc. A zinc chromate prime coat of paint at the spray booth is given all parts before assembly. Sub-assemblies are first made in jigs, and after assembly to their component parts, move to the paint shop for final painting before going to the final assembly area.

Parts Inspection

Castings, forgings, stampings or other parts requiring machine work, move directly to the machine shop from the raw materials storeroom, which is adjacent to it. Inspection is given all these parts as they are received in the storeroom before being sent to the machines. After machining they are again inspected at the inspection crib and then sent to the adjacent sub-assembly department, after which parts are given a prime coat of paint and delivered for final assembly.

On the final assembly line, a separate storeroom of finished parts is maintained. Here an accurate chart record is posted, showing the supply of the various component parts. Production schedules are kept moving as complete airplane parts must be available when the fuselage moves onto the final assembly line. The progressive type of production, used in the automobile industry, has been followed as far as it is practical.



Assembly jigs are constructed of structural steel shapes, fabricated with welding wherever it is possible

An experimental airplane construction department of ample area is located off from the main assembly floor under the mezzanine. Completely separated from the main shop, secret work can be conducted and only authorized employees admitted to this section. This unit has its own storeroom and work benches, parts being fabricated in regular shop departments.

Experimental "mock-up" room is located on the mezzanine floor and is completely walled in, entrance being permitted only to authorized persons. This area is located adjacent to the engineering department to facilitate required work.

An experimental laboratory for testing new devices or parts is on the main floor and is kept locked at all times. Adequate testing machinery is installed to conduct tests and independent research of processes is carried on by a special engineering group.

Flight test department is near the hangar doors, enabling flight crews to have field access for flight observation. Experienced aerodynamic engineers conduct tests and supervise wind tunnel work.

Separate Utility Building

Processing work is done in a separate two-story building containing 6804 sq. ft. of floor space and housing the electric heat treating furnace, hydraulic presses, drop hammers, Pettingill hammers and anodic tanks. Noisy and high-risk operations are thus kept out of the main unit production area. Paint shop, wood mill and pattern shop are also in this utility building.

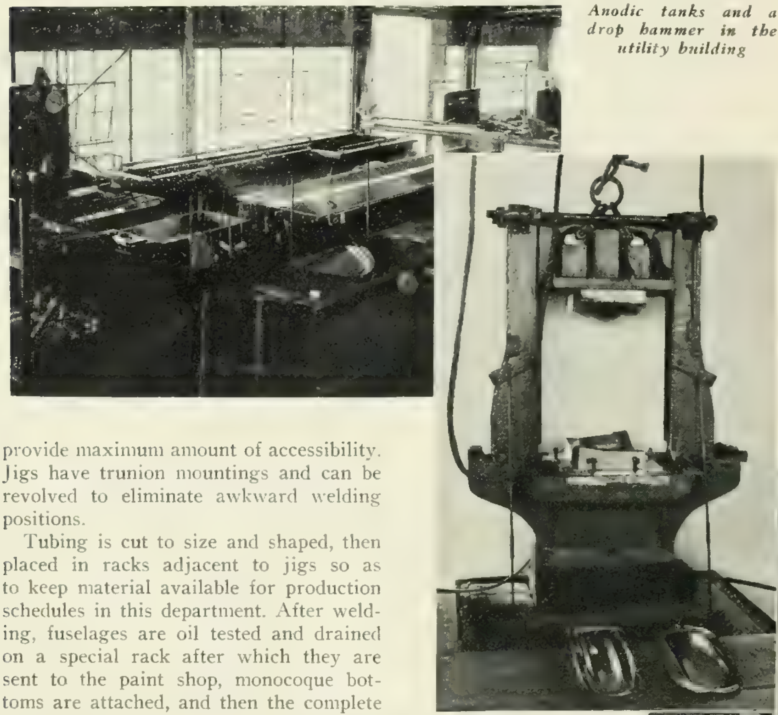
As is modern aircraft production practice, much time and planning was spent on tools and jigs. Complete sub-assembly and assembly jigs have been worked out to speed production and to assure absolute alignment. As in other departments, these facilities have also been designed to take care of expansion in production when it is necessary.

All equipment has been placed for efficient production and any new equipment is of the most modern type adaptable to aircraft production. Adequate spacing is given all machines in the machine shop

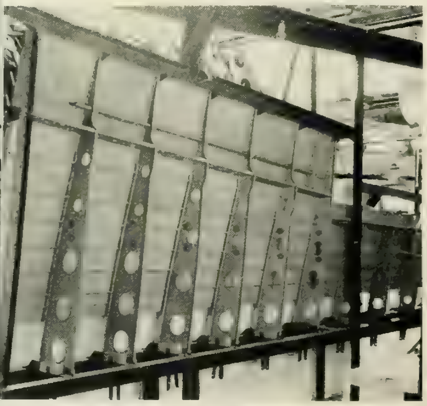
Final assembly floor of the North American Aviation, Inc.

and each is individually conduit wired and connected to a central control panel; also, each machine has an individual compressed air line.

Five separate jigs are used—tail section, fuselage sides (right and left), control section, and engine mount. In the construction of the North American Aviation type of welded steel tube fuselage, detail parts of this structure have been divided into as many sub-assembly parts as possible so that welding operations can be accomplished on suitable benches. These finished assemblies are then welded into position in the main assembly jigs to speed up operations and provide maximum amount of accessibility. Jigs have trunion mountings and can be revolved to eliminate awkward welding positions.



Anodic tanks and a drop hammer in the utility building



One of the metal wing assembly jigs in the sheet metal department

Tubing is cut to size and shaped, then placed in racks adjacent to jigs so as to keep material available for production schedules in this department. After welding, fuselages are oil tested and drained on a special rack after which they are sent to the paint shop, monocoque bottoms are attached, and then the complete fuselage frame is delivered to the final assembly line.

Soft metal dies are used to shape small parts where practical, much time being saved in this process as compared with hand fabrication. Improvement in design has been made in the specially-built hammers in use at North American Aviation. Their capacity ranges from 1000 lbs. drop heads to 2500 lbs., assuring clean and uniform metal parts with low production time. To eliminate excessive handling of these heavy dies, the die foundry is located adjacent to the hammers and storage is made just outside.

Hydraulic presses are used to shape metal parts requiring more even pressure and a better flow of metal than is capable on the drop hammers. Such parts as fuel tank sheets and stabilizer surfaces are formed on these presses.

All die work from making patterns and plaster molds to casting the zinc dies in the foundry, as well as the operation of drop hammers, hydraulic presses, heat treatment furnaces, plating, etc., is done in the utility building.

Anodizing tanks are heated by immersion type electrical heaters which provide more accurate heat control than other types. Also, power factor is maintained at a more even rate in the factory because it offsets the use of the many lights, numerous drills, and small motors used in production. Sanitary working conditions around this department are further improved by having the electrolytic spray drawn off by a blower system. Size of tanks is 24′ × 2′ 6″, with a capacity of 950 sq. ft. of material. These tanks are in operation 24 hours a day.

Every effort has been made to equip the laboratory with apparatus as completely as aircraft production requires. Work done in this unit comprises volumetric and gravimetric analyses; investigation of hydraulic control lines and flexible hydraulic joints; quality of "quench" determination of duralumin by means of solution tests; a salt spray cabinet which is used to determine aging and corrision of duralumin; investigation of pH of oil (quenching or heat-treating oils), engine oils, fluxes, etching solutions, etc.; and complete metallurgical analyses. Apparatus for testing cables, fabrics and permeability of paint films is also provided. Included in the laboratory equipment is a tank vibrator and a 100,000 lb. Riehle metal testing machine by which extremely close results are obtained.

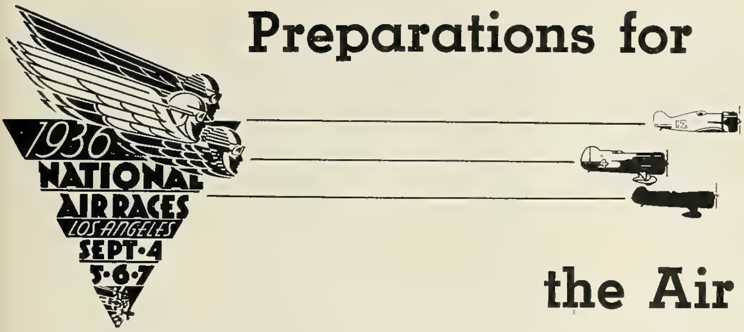
At present North American Aviation is in production on an initial order for 95 basic training planes (BT-9) for the U. S. Army Air Corps, and on float type landing gears for the U. S. Navy. Engineering design of the training plane took into consideration modern military requirements, with construction to meet the demand of hard service with ease of maintenance and also interchangeability of parts so as to economize on spares carried. The plane is a full cantilever low-wing monoplane powered by a 450 hp Wright Whirlwind engine and has all-metal stressed skin wings, and flaps, welded tubular fuselage, and fabric and metal covered tail surfaces.

The organization is composed of two divisions—Operating and Manufacturing, the latter being a consolidation of the facilities of General Aviation Manufacturing Corp. (B/J Aircraft and Fokker Aircraft companies).

J. H. Kindelberger was elected president of North American Aviation Inc. in 1934 and is general manager of the manufacturing division. Until joining North American, he was vice-president of Douglas Aircraft Co., being responsible for engineering and design. J. L. Atwood is vice-president and chief engineer of the manufacturing division, other personnel in this division including R. H. Rice, chief of stress and design; J. S. Smithson, in charge of projects and drafting room; N. S. Shropshire, executive engineer; E. R. Doak, factory manager; and Robert McCulloch, factory superintendent.

Harvey Tafe is assistant to Mr. Kindelberger; R. A. Lambeth, comptroller; Robert Monroe, purchasing agent; Robert Dawe, chief inspector; and D. E. Blasdel, personnel manager.

Preparations for the Air Races



● With the 1936 National Air Races—the 16th Annual World's Premier Air Classic—but a little more than a month off, indications are that it will surpass all previous air meets by a wide margin. More prize money has been added so that the total of the purse this year amounts to $70,000 or $20,000 more than was available for the 1935 Cleveland races.

New, faster and more powerful planes are being constructed behind closed doors, which, if reports emanating through various channels can be relied upon, mean that world speed marks for airplanes will be set at the Municipal Airport Sept. 4, 5, 6 and 7. Construction work on the grandstands, which will seat 60,000 persons is now well under way.

For the first time in National Air Race history several foreign planes have been entered in the events, with foreign speed pilots competing with the speed fliers of America to give the races an international complexion. Michael Detroyat, French acrobatic flyer was the first from abroad to enter for the Thompson trophy. He is flying a Caudron-Renault and has announced he will enter his plane in other events in which he is eligible.

The Ruth Chatterton Trophy race for Sportsmen pilots—men or women—has another famous foreign entrant, Miss Peggie Salaman, British society girl, an outstanding European flyer who, with only 50 hours of time, broke existing records in November, 1931, for the 7000-mile London to Capetown flight. Since then Miss Salaman has won many trophies in international air meets in Europe and is regarded as one of their outstanding women pilots. This will be her first American appearance.

Mrs. Grace Prescott, last year's winner of the Chatterton trophy race and Leland Hayward are already entered. Approximately 100 planes are expected to take off from Cleveland, August 29 to finish in Los Angeles on Sept. 5.

The line-up of the pilots for the Thompson Trophy, an international free-for-all for men pilots only, with a total purse of $20,000 and the Bendix Trophy Race, a free-for-all transcontinental speed dash from New York to Los Angeles with a $12,500 total purse, and the Greve Trophy, free-for-all, for men pilots only, with a total purse of $10,000 will see America well-represented by Ben O. Howard, with his *Mr. Mulligan,* Roscoe Turner, who is building a new special racing monoplane, Harold Neuman, 1935 winner of the Thompson Trophy and Keith Ryder, designer of many fast record breaking planes. Wind tunnel tests on some of the models being built are said to indicate speeds from 338 to 350 mph. Frank Hawks is reported to be building a plane in the Gee Bee plant at Springfield, Mass. Pilot Crosby is said to be building a plane around the Menasco engine for the Thompson Trophy race. Iskhosk Wittman has completed a major rebuild of his Oshkosh D-12 Special which finished third last year and will fly it in the Thompson. The Keith Ryder all-metal Wasp-powered plane which reached Cleveland too late last year to enter is being rebuilt for the Thompson Race this year which is open to any type airplane equipped with any type of engine or engines. Distance is 150 miles, 10 laps over a 15-mile course. The qualifying speed is 225 mph.

Of the $20,000 total purse offered in the Thompson Trophy Race, $17,500 will be scaled down from 40% for the winner to 5% for sixth place. In addition, $2500 of the total purse will be awarded to the winner, provided his speed exceeds the present National Air Race record of 252.686 mph.

The Greve Trophy race will be flown 20 laps of a 5-mile course, with contestants restricted to men. The first of the Greve Races will be flown on Friday; the second on Saturday and the third on Sunday. The sum of $8,500 will be divided between the winners of first six places, and an additional $1500 will go to the winner if he exceeds the present record of 213.257 mph for engines having not more than 550 cu. in. displacement.

Amelia Earhart is sponsoring a trophy race again this year; it is for women pilots only, with a total purse of $1500. Distance 25 miles, 5 laps over the 5-mile course. Qualifying speed 100 mph.

Shell Oil Co. is sponsoring three events. The first, the Shell Trophy, is a 375 cu. in. race free-for-all, for men pilots only. It has a total purse of $6000. Distance 100 miles, 20 laps over the 5-mile course. Qualifying speed 175 mph. The second, the Shell Award, free-for-all, men pilots only is also a 375 cu. in. race with a total purse of $3000 and covers a distance of 50 miles, 10 laps over the 5-mile course. The third is the Shell Cup Race for 550 cu. in. displacement, free-for-all (men pilots only), with a total purse of $3000. This is for 50 miles, 10 laps over the 5-mile course.

As usual the military services will be well represented with the Navy and Army participating. The Navy will send 18 Grumman fighters and the Marines will be represented with 12 Vought Corsairs. There will be the usual aerobatic program, sky writing and a display of planes from the early models.

The Junior Chamber of Commerce plans to stage an inaugural parade from downtown Los Angeles to the Municipal Airport Friday Sept. 4, the opening day. Clem Sohn will do his delayed bat wing jump and each day's program will close with a mass parachute jump made by 60 parachute jumpers. In addition to the featured races, there will be two 266 cu. in. free-for-all races, limited to men, for a total purse of $2400. One race will be run off on Saturday, the other on the following day.

The air race, through tradition, serves as a constructive annual rendezvous of all departments of American aviation, including pilots, technicians and executives, and also affords an opportunity for the Naval and Military Air Services to demonstrate publicly their progress in flight and tactical maneuvers. Each year the event brings into competition new aircraft and provides an incentive for research and experimental developments of greater horsepower from existing engines and greater aerodynamic efficiency. These developments unquestionably react to the advantage of aviation and offer a practical supplement to individual research.

The National Air Races, this year, are being conducted by National Air Races of Los Angeles, Inc., of which Carl B. Squier is president, Don P. Smith, vice-president, W. P. Balderston, secretary and Oscar A. Trippet, treasurer.

X-Ray Inspection of Aircraft

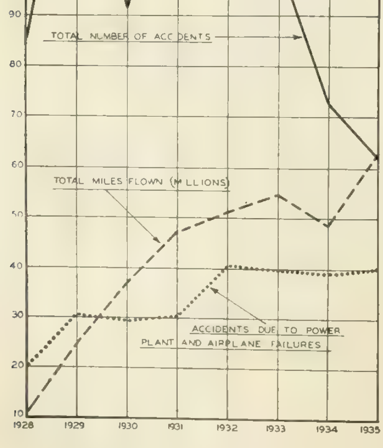
HERBERT R. ISENBURGER

St. John X-Ray Service, Inc.

Paper exograph of two aluminum castings for engine rocker arm housings

● Unlike other methods of transportation where the conveyance can be stopped for checking a suspected failure, the airplane, in most instances, must be brought to earth before an inspection can be made. If anything has gone wrong in a structural member, it might fail during the landing impact, and in some failures the blame has been placed on the human element where the actual defect could not be ascertained.

The accompanying chart (prepared from data published by the Bureau of Air Commerce) relates to scheduled airline operations. The lowest graph shows the steady increase in total mileage flown each year from 10,500,000 miles in 1928 to 63,500,000 miles in 1935. The top graph shows the steady decline of accidents during that period. Accidents traced to defective material or faulty workmanship are represented in percentages and are shown in the center graph which indicates a steady increase until 1932, since when a 40% level has been maintained, although the total amount of accidents decreased almost 50% during the past three years. This implies that the third graph would have been on the up-trend had not flying conditions and experience improved considerably, thus making for a lower accident record generally.



Mileage and accident curves for scheduled flying in the United States

Evidence with Each Plane

One of the foremost aids to insure that aircraft materials be sound and maintained by thorough checks during the life of the plane, is X-ray inspection(1) which reveals the interior condition of structures and parts. The method may be applied while the plane is under construction, and periodically thereafter while the ship is in service. The X-ray evidence in the form of the original negatives can be furnished with each ship and all negatives obtained from periodical examinations, together with the original exographs, may be kept at the home port of the plane for comparison purposes and for the records.

The importance of radiographic inspection has been realized in Europe to a greater extent than in this country, and practically every aircraft factory abroad is equipped with X-ray apparatus. To the author's knowledge, there is no aircraft factory in this country equipped with radiographic units, although some light-metal foundries are X-raying their castings. The only non-destructive test manufacturers rely upon today is magnetic analysis which is restricted too in its scope. While this procedure supplies evidence of defects which may lie close to the surface, it does not give a permanent record. Aside from this, however, the only inspection is a visual one which is used as a final check before the ship leaves the factory and while it is in service. Yet, X-ray inspection, in both instances, may bring to light faulty material or poor workmanship caused by internal defects which can not be disclosed in any other way. Proof of perfect parts and workmanship is desirable for the manufacturers' own satisfaction, the purchasers' surety, and the public's confidence. The requirements of greater speed and load upon modern airplanes may cause unforeseen strains in structural parts of the ship resulting in cracks, which would show up by periodical X-ray inspections.

Origination

X-ray work in the aeronautical field was first undertaken during the World War at the Woolwich Arsenal, England, and was especially concerned with the inspection of welded steel fittings and glued wood joints in wings. M. Gaëtan Py, in his *Progress Report on Metallurgy to Aircraft Materials*(2), first emphasized the importance of X-ray inspection, and from that time numerous articles dealing with the subject have appeared(3). Characteristic and interesting for the early period of X-ray inspection is an exograph representing part of an airplane propeller made in 1926. Among more recent literature are the reports published from time to time by Paul Brenner(4), and who in his latest report shows exographs of modern metal propellers. In one case a loosened nut is visible in the inner armature. Poor cable connections are illustrated as well as cracks in bolts. Defective lead-bronze bearings, casting defects and the like are also depicted. Special attention has been paid to welded structures, to steel as well as light metal, and to fusion as well as spot welding. Even rubber tires with wire inserts have been inspected.

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(1) *X-Rays and Their Application to Aircraft Materials*, by H. R. Isenburger. *Aviation Engineering*, August, 1930.

Portable Equipment

Portable X-ray equipment, suited for inspection in the field as well as in the shop is available today. The equipment includes a simple switchboard with control meters from which the equipment can be operated. The X-ray tube is housed in a ray-proof and shock-proof metal case with a small opening through which the useful rays escape. Flexible shock-proof cables carry the high voltage from the power plant to the tube, and the current required to generate the high voltage is supplied by the automobile engine. This makes the entire unit self-contained and independent of an outside power source. The tube can be mounted on a stand with a swivel device or used without the stand. The peak-kilo-voltage supplied is sufficient to penetrate two inches of solid steel in one-minute exposure at 24-inch focus to film distance.

It is comparatively simple to X-ray aluminum castings and other small parts before their installation. The final inspection of an assembled ship, however, is more difficult. Besides having a thorough knowledge of the basic theories of X-ray inspection, the operator must be acquainted with the structural parts of the airplane under inspection so that he knows what to look for. Care must be taken of factors which have a bearing on the correct interpretation of the resulting exographs. While the X-ray tube is on one side of the object and the film on the other side, precautions must be taken to prevent scattering and undue distortion from parts lying between the tube and the film. This can be done in various ways. To avoid back or side scattering from reaching the X-ray film, special exposure folders are placed in lead backed cassettes. The film itself is placed between the two intensifying screens in the folder, the screens helping to speed up the time of exposure. Frequently, it becomes necessary to determine the location of a defect. By two stereoscopic negatives and a special viewing arrangement it is possible to observe a section three-dimensionally. A simpler and more rapid method is the double-exposure technique whereby two images of the section are obtained on the same film by merely shifting the tube a short distance between exposures. Reference markers on the far and on the near side of the object, help in a determination of the exact distance of a defect from the film.

Exposure folder, or X-Ray "camera"

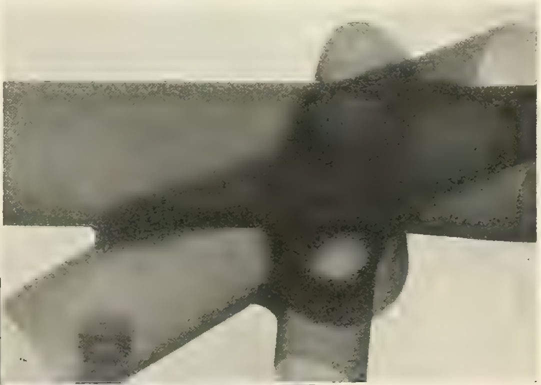
Frequently a small hand-set X-ray apparatus is powerful enough to inspect aircraft materials. Such a unit can be carried by one man and can be used on steel up to ½ inch thickness. Exographs of complicated fuselage joints are shown in the accompanying illustrations; all represent sound welds. One shows a positive print from a film negative and the other is a paper negative. In the latter, the X-ray shadowgraph has been recorded on a sheet of paper which has a sensitive emulsion on one side. The perfection of such X-ray paper represents a recent development and promises to reduce considerably the cost of the inspection procedure. While it gives better contrast for certain applications, it does not always furnish as much detail as is obtained with film. The paper exograph representing two aluminum engine housings leaves nothing to be desired from any kind of X-ray negative. The castings are sound throughout and the contrast between parts of varying thickness is well brought out. Another interesting application is the determination of the height of liquid in a valve.

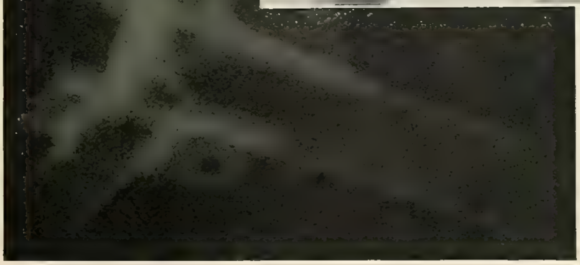
Reducing Rejections

A manufacturer in another industry stated recently that he had about 25% rejections when his company first installed X-ray equipment. Within two years it was 5%. He attributed some of this improvement to the psychological effect which the X-ray check has on personnel, and expressed the opinion that rejections would return to the 25% level quickly, should X-ray inspection be discarded. As in this instance, the value of this inspection device has been definitely established in many other industries.

The unavoidable loss of contrast and definition in reproducing the accompanying illustrations is due to the necessity of reproducing them by the halftone process.

X-Ray photograph of a complicated welded steel fuselage joint





An X-Ray photo on sensitized paper, showing welded joint

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2. *Memoires de la Soc. des Ingenieurs Civils de France*. January-February, 1928.
3. *Industrial Radiography*. Ancel St. John and H. R. Isenburger. Bibliography—Reference Numbers: 182; 252; 253; 257; 351; 364.
4. *Zt. f. Flugtechnik & Motorluftschiffahrt*. Sept. 28, 1933. *Luftwissen*. Vol. 2. 1935. pp. 85-91.

WING-FUSELAGE INTERFERENCE

and Tapered Wing Roots for Low-Wing Monoplanes

ALFRED ZAVEN BOYAJIAN

Because there are as yet no criteria for the design of wing roots for a low-wing monoplane, a designer today employs extensive experimentation to find wing roots best adapted to his airplane. However, if he had general knowledge of some fundamental concepts governing wing-fuselage interference, he would be in a better position to comprehend his particular case and its needs, and he would be able to make a reasonably good first approximation of wing root design without resorting to tedious preliminary trials of experiments. With such basic concepts in mind, he can distinguish between the relative behaviors of various types of wing roots, choose one, and build up on it knowing that he is headed in the right direction. It is, therefore, the purpose of this report to convey to the engineer some fundamental concepts governing wing-fuselage interference for various types of roots.

● Little attention has been paid to tapered wing roots because basically they appear to violate the important wing theory principle that the lift on a given airfoil is proportional to its chord length and thickness. However, the following test results indicate an exception to this theory in the presence of a body.

Performance curves for the tapered wing roots were obtained from wind tunnel tests, and were compared with those for conventional unfilleted and filleted wing root combinations under similar conditions. For tapered or cut-away wing roots, wing theory would ordinarily prescribe a reduction of efficiency due to a decrease of lift over that section, together with an accompanying increase of induced drag. However, contrary to theory, the exact reverse is the case. There was a substantial increase of efficiency due to both an increase of lift and a simultaneous decrease of drag. This condition of favorable wing-fuselage interference existed only for low angle of attack conditions, up to and including the best climbing angles. Above this angle of attack range, and after a sudden collapse of this favorable interference, the tapered or cut-away wing roots behaved normally and according to wing theory. However, for $L/D_{\max}$ conditions, these tapered wing roots showed increases ranging up to 45% over the $L/D_{\max}$ for conventional straight wing roots without fillets, for the model used, the higher efficiency being due to an artificially sustained lift over the wing root section. This may be called an induced lift over that section, and as later explained, is the result of the natural tendency of the circulation over the wing to maintain itself from the wing tip to the fuselage when the existing wing-fuselage interference is not too unfavorable.

To make a more comprehensive study of the phenomena involved in wing-fuselage interference, visual tests of the airflow in the wing roots were made with fixed and movable pieces of woolen yarn. The visual effects were found to be in compliance with the theories evolved from the performance curves of each wing root.

At all angles up to about 7° angle of attack the tapered wing roots displayed much smoother airflow than the wing roots with large fillets. These latter, in turn, were vastly superior to the highly turbulent wing roots without fillets. Above 7° angle of attack, the airflow at the tapered wing roots was only slightly more turbulent than the case with large fillets.

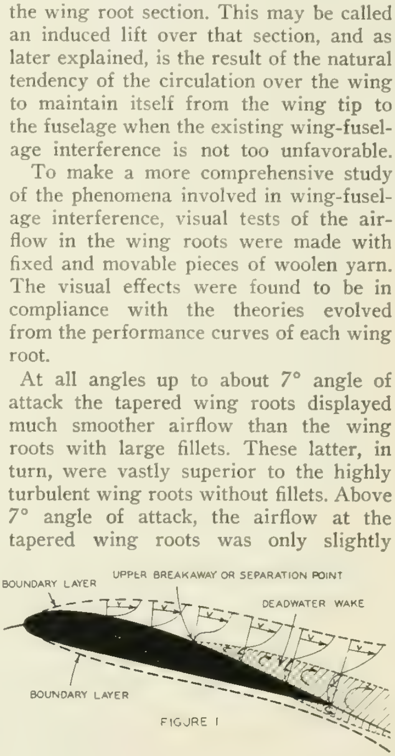


FIGURE 1

The apparent smoother airflow together with the high efficiency curves obtained for the tapered wing roots indicate that they present one of the most favorable conditions of wing-fuselage interference for a low wing monoplane at the angles of attack mostly used.

To explain wing-fuselage interference, it is necessary to go into detailed airflow theory. In order to build up concepts on interference, elementary boundary layer phenomenons, etc., must be considered. The theoretical discussion of wing-fuselage interference follows.

General Considerations

A boundary layer phenomenon is associated with bodies (such as airfoils and fuselages) moving through viscous fluid which, to a great extent, is caused by surface or skin friction. Within this boundary layer the fluid suffers a velocity deficit. As the boundary layer is penetrated deeper, (that is, as the actual surface of the body is approached), the fluid velocity is increasingly impaired until the velocity becomes zero at the surface of the body. The outside limit of the boundary layer is at a distance off the surface of the body where the velocity of the fluid equals the velocity of the fluid at a remote distance from the body.

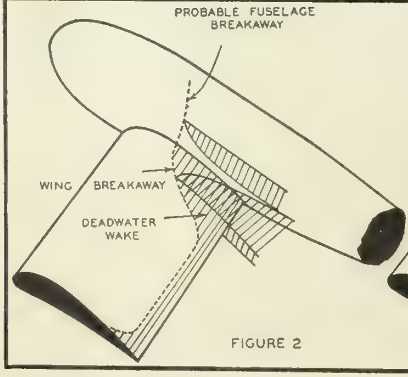


FIGURE 2

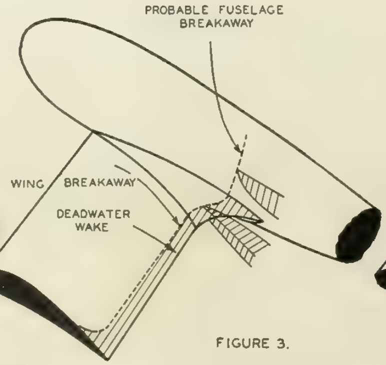


FIGURE 3.

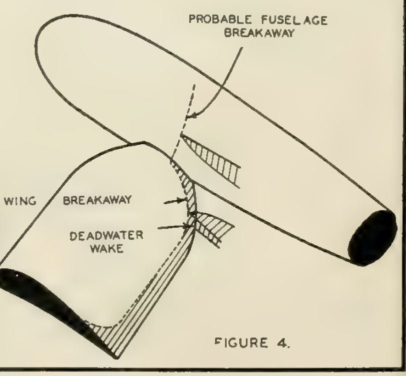


FIGURE 4.

The boundary layer gradually thickens in a downstream direction because the effect of surface friction is accumulative, and more and more kinetic energy is absorbed from the moving fluid. If the boundary layer becomes sufficiently thick, the fluid will separate from the body, become turbulent, and negative velocity components will appear. That is, just off the surface of the body the fluid is moving in an upstream direction, as illustrated in figure 1 which shows the boundary layer with exaggerated thickness for detail.

Behind the breakaway point is a deadwater wake resulting in a pressural drag. This wake also causes an automatic reduction of circulation over the airfoil and consequently a reduction of lift.

If two bodies, such as a fuselage and wing, are placed adjacent, the boundary layers add to each other. Because the boundary layers are thus abnormally thickened, the separation or breakaway points advance locally in an upstream direction. In this manner the interference between boundary layers causes a local increase of deadwater area, a local increase of pressural drag, a local decrease of circulation, hence a local decrease of lift, and an increase of induced drag.

Therefore, the best wing root, from the standpoint of interference, is one which can eliminate or reduce the advances of the breakaway or separation point, and eliminate or reduce the deadwater wake near the fuselage. If this can be done, then the sequence of events occurring because of the local advance of breakaway point can be avoided, and a loss of aerodynamic efficiency prevented, giving the aerodynamically ideal wing root.

Wing Roots Without Fillets

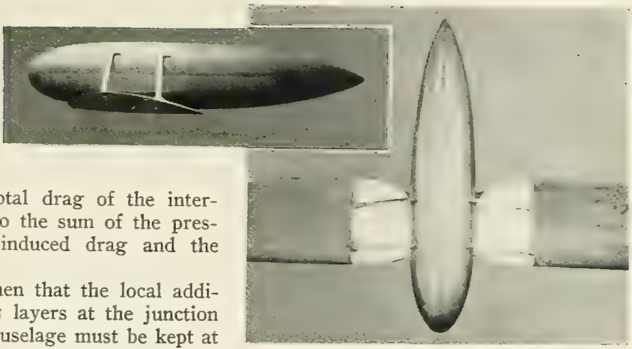
Figure 2 diagrammatically indicates the result of the mutual interference between boundary layers of the wing and fuselage in the case of a straight continuous wing root with no fillets.

Local advance of the breakaway due to the local thickening of boundary layers (due to the local additions of wing and fuselage boundary layers) causes a local advance of the breakaway points indicated in the diagram near the fuselage.

This advance of the breakaway or separation causes a local increase of deadwater wake, which in turn, results in a local increase of pressural drag. The local increase of the deadwater wake also causes an automatic local reduction of circulation over this region of the wing root and hence a local reduction of lift, which in turn causes a local increase of induced drag.

In this region there is also a frictional drag proportional to the wing root chord, and fuselage cross-sectional radius.

For the straight continuous wing root, both the local increase of pressural drag, and the local increase of induced drag are large. The total drag of the interference is equal to the sum of the pressural drag, the induced drag and the frictional drag.



Side and top views of model

It is evident then that the local additions of boundary layers at the junction of the wing and fuselage must be kept at a minimum to delay the sequence of events following thereafter. Additions of boundary layers can be best controlled by the geometric design of the wing roots and fuselage.

If the fuselage section is circular or elliptical, a wedge-shaped pocket or crevice will exist at the junction. In such a crevice the boundary layers add up considerably and the resultant turbulance and deadwater wake reaches outward along the wing so much that a low wing root efficiency results. If the fineness ratio of the fuselage is large, and if also the largest cross section of the fuselage is ahead of the trailing edge of the wing root, then the resultant expansion of airflow in this region will further impair the already low wing root efficiency, because the expanding airflow tends to increase the pressural drag.

Roots With Large Fillets

Figure 3 shows diagrammatically the result of mutual interference between boundary layers of the wing and fuselage in the case of a straight wing root with large fillets. A standard optimum fillet was used.

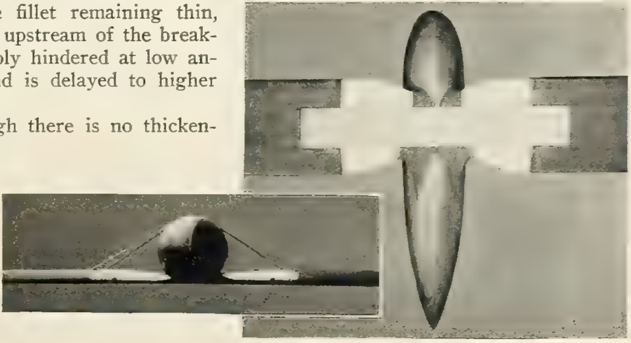
The large fillet is so placed at the wing root as to fill the wedge-shaped pocket or crevice caused by the intersection of the wing and fuselage curved contours. It has the chief function of removing the crevice where severe boundary layer interference can occur. Unlike the previous case, there is only one boundary layer at the junction because the surface of the wing is faired into the fuselage. Consequently there can be no thickening of boundary layers due to the addition of several boundary layers. With the boundary layer on the fillet remaining thin, the local advance upstream of the breakaway is appreciably hindered at low angles of attack, and is delayed to higher angles.

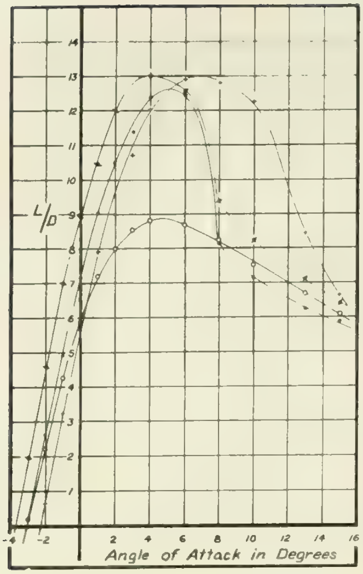
However, though there is no thickening of boundary layers due to the addition of several boundary layers, the boundary layer near the trailing edge of the fillet is thicker than that at the trailing edge of the remainder of the wing. This is due because the increased chord length makes an increased surface area and thus an increased frictional drag. Therefore, if a fillet is made too large, the benefits derived from it will be overcome by the unfavorable reactions resulting from an increased frictional drag.

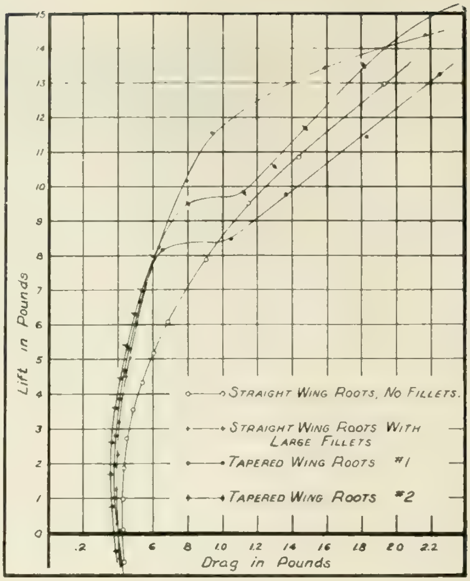
Considering the case of an optimum fillet where the frictional drag is not too severe, the breakaway point will not advance (locally) upstream as much, due to boundary layer thickening, as in the case of a straight wing root with no fillet. There is a comparatively less local deadwater wake, and consequently a lower local pressural drag over the fillet. The fillet is made with increasing radii in a down-stream direction, thus reducing the expansion or divergence of airflow near the fuselage, and giving additional decrease of pressural drag. The net result is comparatively less reduction of circulation over this region, giving a lesser decrease of lift, and also a lesser increase of induced drag. The delay of separation is evident in the lift and drag curves for this wing root.

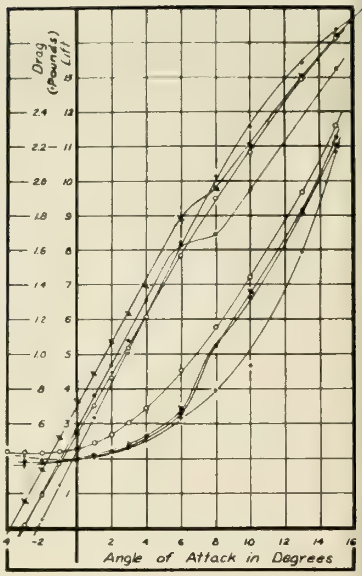
Compared with the wing root with no fillet the large fillet offers a decrease of pressural drag, a decrease of induced drag and an increase of frictional drag.

Front and bottom views of model









Therefore, the total drag of the wing root with large fillet can be expected to be less than the total drag of the wing root without fillets. Lift on the former can also be expected to be higher than the lift on the latter wing root.

Care must be taken in the application of fillets to wing roots. If the fillets are not correctly placed, or if they are too large, they will impede, rather than improve, aerodynamic efficiency of the roots.

Tapered Wing Roots

Tapered wing roots were conceived to reduce expansion and divergence of airflow over wing roots. Small fillets were used for fairing-in purposes. Figure 4 shows diagrammatically the result of the mutual interference between the boundary layers of the wing and the fuselage in the case of tapered wing roots.

In this case the fuselage boundary layer remains approximately the same as the previous cases. However, because the chord length of the wing root section adjacent to the fuselage is less than the unfilletted straight wing root, the boundary layer on the tapered wing root is less both in length and thickness. Therefore, when the boundary layer of the tapered wing root adds to that of the fuselage, total thickness of boundary layers is less than that of the straight wing root with no fillets. Since the chord length and hence the boundary layer, is also short, the local breakaway or separation point does not advance upstream to any great extent. Therefore, there is little increase in local deadwater wake and pressural drag. The local automatic reduction of circulation will be slight as will be the loss of local lift. Thus the circulation and lift of the outer wing tip tend to maintain themselves constant over the tapered wing root. This phenomenon is not stable for all angles of attack, and prevails only at low angles of attack.

The result of this constancy of circulation is the tendency to maintain an artificial or induced lift over the wing root of narrow chord. Thus there is more lift on the wing root than that prescribed by wing theory (lift proportional to chord). The lift on the tapered wing is, therefore, greater than the lift on the straight continuous wing root.

Because the circulation and the lift over the tapered wing root have been abnormally and artificially maintained to a greater degree than in the case of the straight continuous wing root, the induced drag of the former is less than that of the latter. The pressural drag of the tapered wing root is less than that of the straight continuous wing root. Because the surface of area of the tapered wing root is small compared to the straight continuous wing root, the frictional drag of the former is also less than that of the latter.

Therefore, in low angle of attack ranges there are three reductions of drag for the tapered wing root over the straight continuous wing root, pressural drag, induced drag and frictional drag.

As stated, the phenomenon of this artificially maintained circulation (and hence induced lift) was stable only at low angles of attack. As the angle of attack increases the boundary layer of the wing thickens, causing an advance upstream of the breakaway or separation point as the angle of attack is increased. A critical angle is soon reached when the deadwater wake so increases the local pressural drag that excessive reduction of local circulation and lift results. Then as the reduction of lift becomes sufficient, there is a sudden shedding of a large vortex at wing root, bringing about an immediate sudden collapse of the induced lift at the wing root. Associated with this condition is an equally sudden increase of induced drag. These phenomena are indicated by the sharp breaks in the lift and drag curves of the tapered wing occurring at about 7° angle of attack.

Above this critical angle the vortex is sustained and the tapered wing root conforms with wing theory. With further increase of angle of attack the lift and drag curves rise normally without any additional discontinuities.

Physical factors such as size and position of wing spars limit the maximum taper on a wing root. However, within such limits, the geometric taper of the wing root as well as the airfoil section can still be sufficiently varied to permit great variations in the character of the lift and drag curves. Depending on the combination of the physical variations made, the sharp breaks in the lift and drag curves can be made more gradual or more abrupt. Furthermore, breaks can be advanced or delayed by several degrees in the angle of attack at which they occur. Sound reasonings of airflow concepts as well as experience will enable one to design tapered wing roots with the character of curves desired.

Gaining by the experience acquired from the first set, and especially by the new knowledge of the airflow phenomena involved, the author was able to design subsequent tapered wing roots with improved aerodynamic efficiencies.

An Example

Following is an example which demonstrates how knowledge of the airflow

(*Continued on page* 58)

EDITORIALS

"We who are in aviation carry a heavy responsibility on our shoulders, for while we have been drawing the world closer together in peace we have stripped the armor of every nation in war. It is no longer possible to shield the heart of a country with its army. Armies can no more stop an air attack than a suit of mail can stop a rifle bullet."—COLONEL CHARLES A. LINDBERGH.

Superiority In Performance

● Insofar as aircraft is concerned, Europe is an armed camp. Each country is utilizing the utmost of its specialized manpower in airplane and engine factories, turning out products destined either to maintain the status quo or plunge the Continent into another embroglio which will far overshadow the World War in viciousness.

We in the United States know that at present it is impractical to think of matching foreign countries in number of aircraft. So, we are apt to fear for the supremacy of our equipment.

That these fears are ill-founded is the view of Tom Hamilton, United Aircraft executive and European representative, just returned from abroad. Having seen most of the recent developments in Great Britain and on the Continent, Mr. Hamilton believes that the British pursuits and interceptors, light and medium bombers, while admittedly fast, do not exceed in this respect the best we have to offer. In maneuverability, we definitely have the edge, as well as in our most recent bomber designs, nothing comparable to which is seen anywhere else.

While it is encouraging to know that we still make the world's finest aeronautical products, it would be even more encouraging if we built up our Army Air Corps to a position comparable with the type of equipment it flies.

Sixty new American fighting planes will take to the air each month for the balance of the year, and 500 will have been delivered before a new year rolls around. Faced with Congressional criticism because of its method of procurement, the War Department perfected its plans and installed a new system which has accelerated delivery, possibly by the elimination of much red tape.

Public criticism of Congress will spur it, as it has spurred the War Department. Cutting the purse strings of appropriations for equipment called for by law, would help return this country to the forefront as a power in military aviation.

Traffic Records Going Up

● When the prediction was made here last year that more than 750,000 persons would fly with American air transport companies during 1935, some received our prognostication with a few mental reservations. The prophesy not only came true, but was more than fulfilled.

This year we can safely predict that the one million mark will be reached, and we are backed in our contention by officials of the leading units of the industry. They agree that the lure of the air and the increasing demand for speed in travel will boost 1936 figures to unprecedented heights. Thus, 1936 will be the biggest and best year in the ten years' history of the transport companies.

Traffic in passengers, mail and express is already ahead of 1935. Fears that reduced railroad fares would cut heavily into air traffic have thus far proved unjustified. More rail and more express are being carried further than before. Larger and more pretentious airliners are being developed for service this year, with even larger units already in the initial stages of development.

Civil Airways Regulations

● The recent designation by the Department of Commerce of certain air routes as civil airways will do much to eliminate the possibility of collision in the air, particularly on days of limited visibility.

The new Bureau of Air Commerce ruling, which becomes effective the 15th of this month, is not only necessary for a clear interpretation of the air navigation laws, but is also vital in view of the increasing utilization of the airways by airlines and private pilots alike.

The designations, which define the airways as being 50 miles wide (limits being 25 miles to either side of the centerline connecting airports and other points to show the route) are preliminary to and establish a working basis for regulations to airways traffic control, altitude of flight along airways and instrument flying along these airways in poor visibility. The Bureau's airline regulations require that scheduled airline pilots operating aircraft on intentional instrument flights be so qualified. The present amendment requires all pilots engaging in instrument and radio flying through or over clouds on the civil airways to demonstrate proficiency therein, to have the necessary equipment, and to make flight plans known in advance. Pilots and aircraft not equipped for instrument flying, as outlined by the regulations, will not be permitted to fly "blind" on the civil airways during periods when a weather condition of broken clouds or solid overcast exists. However, they may fly on such airways between the bottom layer of an overcast and the ground provided a suitable safety altitude exists. The amendment is applicable to the civil airways only, and does not restrict flights which do not use the civil airways.

If the Bureau continues to consider recommendations of private pilots as well as airline operators when formulating its rules, it will have done a real service. If on the other hand it ignores the "little fellow" who uses these facilities only on rare occasions, we cannot expect anything more than an unintelligible set of rules which will rile and irritate the very people expected to be benefited.

Airship Versus Airplane Travel

● Realization that Germany has firmly entrenched herself as a successful operator of trans-Atlantic airships may make it expedient that American and British heavier-than-air interests really get going. Seeing the *Hindenburg* take-off with clock-like precision and break records time after time, impresses the observer with the tremendous possibilities of the commercial dirigible.

If the airplane is to make a name for itself as a trans-oceanic vehicle, now is the time to show what it can do. There are many converts to lighter-than-air, and it is time the efficiency of the long range flying boat be demonstrated in competition with the existing line.

Pan American can get started in comparatively short time. It has the personnel and the equipment, at least for experimental work. Imperial Airways, however, is entering an entirely foreign field. Its new Short Brothers flying boats have yet to prove their worth, although they look as though they are capable of doing their assigned tasks.

Since both companies are closely allied in the trans-Atlantic venture, one must wait for the other. Their past performances can be depended upon to bring to trans-Atlantic air travel the type of passenger service for which they achieved their records of dependability.

It may be then that the airship will be preferred for fast freight rather than for passengers seeking the fastest trip possible. At any rate, the airship will have its place and its possibilities can be exploited to better advantage than now.

AVIATION'S LAME DUCKS

Copeland Report Places Blame For TWA Crash On Bureau of Air Commerce—Urges Removal of Vidal and Martin

CY CALDWELL

● There have been some mutterings of discontent heard from one of my six readers over my editorial treatment of Eugene Vidal, one-third of the Director of the Bureau of Air Commerce. (The other two-thirds of the Director are vested by President Roosevelt in the persons of Colonel Carroll Cone and Rex Martin, forming when thoroughly mixed—their normal state—that hydra-headed monster that I have called the Misdirector of Air Commerce.)

Evidently a tender-hearted fellow whose warmth of feelings overcomes his power of critical analysis, he has chided me with applying what amounts to mental cruelty to Mr. Vidal. The unfortunate creature, he says, is handicapped by the condition of divided authority for which the President himself is to blame—a fact that I have stated plainly in previous articles—and that therefore I should blame the President at least as much as I blame Vidal. I certainly do blame the President. His lack of clear thinking on this matter of a three-cornered Director of Air Commerce is quite as apparent as his lack of any sane thought whatever on such other matters as the Florida Alligator Bathing Pool, misnamed the Ship Canal, and the Passamaquoddy tide-juggling scheme with which he has sought to buy votes in the State of Maine. If I have not stressed this matter of Presidential muddle-headedness in the case of Vidal, it was because I was writing about Vidal, not about Roosevelt. Furthermore, Vidal alone must bear the blame for remaining in an impossible situation out of which he could rescue himself at any time by the simple expedient of resigning.

"Overhaul The Bureau . . ."

Recalling the advice of Solomon, "Never argue with wives, drunken men, or readers," it is not my purpose now to argue, but, as the preliminary report of the Senate Committee on Commerce, Report No. 2455, June 20, submitted by Senators Copeland, Clark, and Donahey, confirms practically everything I have said about the Bureau, I shall quote from it:

"We fear that the Secretary of Commerce undertook the impossible when he sought to have successful operation of the Bureau by placing three men with coordinate powers in charge of the Bureau. Certainly there has been grievous lack of cooperation, and in our opinion there are defects so fundamental that they must be remedied before there can be proper administration of this important Bureau.

"We question the professional equipment and preparation of Mr. Rex Martin. A man of much larger experience is needed for this position. He must be chosen, not with reference to his political affiliations, but strictly because of his professional ability, his known success as an administrator, his possession of tact and qualities of leadership. These qualities are not combined in Mr. Martin. . . . Concerning Colonel Cone, we have no recommendation to make. He came through the ordeal without criticism. . . .

"When we approach the question of what to recommend regarding Mr. Vidal, *nominally* in charge of the Bureau of Air Commerce, we are at a loss. He is an amiable gentleman. He has a good background. Our fear is that he is too amiable, that he is lacking in iron, positiveness, and the determination to keep the employees under his direction functioning according to schedule. . . .

"We strongly recommend to the Secretary of Commerce that he thoroughly overhaul the Bureau of Air Commerce with a view to improving its administrative officials. Some one person must be given the responsibility in the way of oversight of this Department, its personnel, and many activities. It may be difficult to find exactly the right individual for the positions; but until there is greater firmness, greater experience with men, larger knowledge of the problems involved, there can be no hope of improvement in the Bureau of Air Commerce."

Which is precisely what I have been saying, in somewhat less polished phrases, for a period of over two years.

Vidal is now in the position of a Lame Duck Congressman who has failed of reelection, whose constituents have kicked him out; but who yet remains in Washington, stubbornly finishing out his term. He is a Lame Duck—and the lamest Lame Duck I have seen quacking about the Washington feed trough. He would rise somewhat in aviation's opinion if he resigned at once. President Roosevelt may not fire him, may not change the present ridiculous system of triple-divided control in the Bureau. The President, who remarked in an unguarded moment that if any of his experiments did not work, he would admit it, has not yet had the political courage to admit to any mistake in anything. It happens that I voted for Dr. Roosevelt, because I liked his platform and thought he was speaking the truth when he endorsed it. Well, turn about is fair play—although I used to be a member of the Democratic party I'm going to fool Il Doo-chay Delano this time by voting for Landon and Liberty. Landon may fool me, too, but at least I won't be tricked twice by the same Fascist Dictator disguised in the asses ears of Democracy.

Inefficiency

While attending the Senate Committee's hearings in Washington a couple of months ago I heard Vidal admit on the witness stand to Senator Copeland that all applicants had political backing, and that none without political endorsement had been appointed to positions in his Bureau.

Quoting now from the Senate report, we have this confirmation: "It has been alleged that there is no merit system in the Bureau which would make for efficiency. When the committee considered the case of Wall, Mount, Miller, and Bourne, not to mention that of Clement, it was constrained to agree that in the last two years the man who worked each day sufficiently to get by that day had less chance of being dismissed than the one who, as a member of the Bureau, would energetically work long hours to carry out the functions prescribed in the Air Commerce Act."

About the removal and furlough without pay of four district managers of the Bureau, Thomas Bourne, L. C. Elliott, I. D. Marshall, and G. C. Miller at Newark, Fort Worth, Chicago, and Salt Lake City, respectively, the report states that former Assistant Secretary of the Department of Commerce, Ewing Y. Mitchell took part as follows:

"Irrespective of the reasons which may have actuated the officials of the Bureau of Air Commerce in originally recommending the removals, Assistant Secretary Mitchell, who sat as a member of the committee while the three men (Bourne, Marshall, and Miller) were being examined, asked each and every one of them whether they did not think that the approval of the New Deal by the people of the United States as expressed in the election of President Roosevelt required a clean sweep of government employees connected with the old deal and whether they did not think that, having held their jobs for a number of years it was time for them to get out and let others have a chance at these attractive and lucrative jobs. He put this question repeatedly and stated in no uncertain terms that it was his opinion that it should be answered in the affirmative, and that new people owing their appointment to the new administration should be given the jobs in order that these good things should be spread around."

Mr. Bourne testified, "I then contacted the Assistant Secretary, Mr. Mitchell, who informed me that I should be willing to step out of the Government service after 9 years and give some of the boys on relief a chance."

So that's what has happened to the merit system in Government service during the present administration, which has given us the most flagrant demonstration of the spoils system in a hundred years. Kick the experienced man out and shove a political appointee into his place. Yet Mr. Vidal told me more than a year ago that no removals had been made for political reasons.

The $700 Airplane Delusion

You may recall that over a year ago I pointed out that nobody trusted anybody else in the Bureau, that brother would knife brother at the slightest opportunity. Here is what the Senators have to say on that score: "In such a big responsibility, reaching through the length and breadth of this great country, it would be well for the Director of Air Commerce to spend most of his time in the field, especially when so much under the present plan is centered in Washington. . . . To do this efficiently would demand that the Director spend at least 50 percent of his time in the field. . . . In all fairness the committee is forced to point out, however, that such work in the field demands loyal lieutenants to act as the Director thinks in the latter's absence. Until July 1, 1935, the Director of Air Navigation Division" (Rex Martin) "was not working close enough with the Director himself, and, during his appearance before our committee in open hearings April 29, 1936, the Director of the Air Navigation Division did not display the loyalty to the Director of Air Commerce which would permit the latter to leave Washington 50 percent of the time."

The committee was very easy on Vidal and his $700 airplane fiasco, but slapped him right down to earth with their conclusions, as follows: "It has been charged that he publicized unduly the $700 airplane, and therefore ruined the sale of small planes, to the embarrassment of certain manufacturers. . . . The Director did err in publicizing the $700 airplane before the vehicle was a reality. . . . we will not consider the question of whether it would be advisable, but we do believe that an airplane or autogiro that will be safe and inexpensive will be constructed to sell for $1,500 within the next 5 years. As we are convinced that it must be an airplane which will lend itself to modern operation methods, we are definite in our statement that the price of the safe private airplane will, for the next 3 years, be much closer to a figure of $4,000 than the $700 plane which has caused so much anxiety within the industry."

Martin The Author

The committee's report on Rex Martin, the gentleman whose verbose testimony put me soundly to sleep last April, makes amusing reading. The committee made the mistake of taking Rex seriously.

Says the report: "Many persons in Government circles and in the private industry have alleged that the Director of the Air Navigation Division did not have sufficient qualifications on assuming office. A summary of his experience and qualifications submitted by the Bureau to this committee claims for him 'United States Army Air Corps, commissioned officer (pilot), 1917-18.' Anyone reading this would naturally think he was in the Army in aviation 2 years during the World War. As a matter of fact, on checking up with the Adjutant General of the Army, we find that he was only in the Army one year, including the few weeks waiting for reporting and the few months as cadet and second lieutenant, respectively. His chief contribution to aeronautics was a three-volume work covering all phases of the subject, wherein he appears as author of 'Commercial Aeronautics.' "

Responsibility For The Crash

The report continues: "Without considering the complaints against this assistant director which have come from the industry and from personnel within his division, the committee has been embarrassed so many times in its investigation of the Air Navigation Division that it is hardly necessary even to consider those that have come to us but, rather, to depend on our own contacts. While there was the appearance of cooperation, there was a continual undercurrent of distrust in the sincerity of the work the committee was doing. It may suffice to say that every attempt made by the committee to point out what might be termed an irregularity was met with defiance or apparently evasive statements. His attitude seemed to be that there 'could be no wrong' within the Air Navigation Division. It is forced to feel that this situation has contributed more than any one factor to the well-known unsatisfactory condition of the important Bureau of the Government charged with aviation safety."

It was at the door of Rex Martin's Air Navigation Division that the deaths of Senator Cutting and four other people were laid. Of the 13 aboard the airliner 5 were killed; all survivors were badly injured. Under the heading: "Cause of the TWA Atlanta, Mo., crash of May 6, 1935," the committee flatly states: "Pilot Bolton, having been obliged to pass up his landing at Kansas City, under direction from proper authority, set a course for Kirksville (Millard) Airport. No evidence of mechanical failure having been found, his safe arrival and landing at this alternative destination was dependent upon three aids to navigation furnished by the Bureau of Aeronautics, Department of Commerce:

"First. Dependability of the North East leg of the Kansas City radio range.

"Second. He needed the normal operation of the MRL radio station at Kirksville.

"Third. He needed the best efficiency on the three rotating light beacons on the last 20 miles southwest of Kirksville (Millard) Airport, Missouri.

"All three failed him."

Time For Action

Surely President Roosevelt cannot longer present a deaf ear to complaints against these two officials, which have been coming to him now for more than two years from a variety of sources. Aviation as a whole demands their removal from these positions of trust in which they very obviously are unworthy of trust; the safety of the American air travelling public demands their removal. Can the President longer ignore these persistent demands? The Committee, of course, puts the matter up to the Secretary of Commerce. But this is mere Senatorial politeness. Old Dan Roper, Secretary of Commerce, cannot reasonably be expected to throw out two incompetents that his Chief, Dr. Roosevelt, appointed, if Uncle Smiley himself does not give the word.

Uncle Smiley, how about it? On your next radio bedtime hour, will you not gladden the ears of your 14-year old radio audience by saying, "My friends, it seems that I was as much misled by Vidal and Martin as I was by the NRA, the AAA, and my other slightly unconstitutional experiments. Without waiting for the Supreme Court to declare Martin and Vidal unconstitutional, I shall startle the world—and perhaps the Supreme Court—by declaring them both unconstitutional myself. They have covered the Bureau, themselves, and even ME in a cloak of derision. Therefore, my friends, I am chucking them out. Listen next week when Uncle Smiley tells you the story of the Big Bad Wolf and the Big Bad Landon."

French Military Aircraft

(Part 1)

●

PEYTON M. MAGRUDER

Mureaux 180 C2

The subject of French military aircraft will be presented in two parts. A general digest of the type and makes of planes used in each category and their approximate performance will be given. Part I describes the fighters: single-place, two-place, and the multiplace or combination fighter-bomber types; Part II will include bombers, reconnaissance, and various types of naval aircraft as well as a tabulation of commercial transports which, with appropriate modifications, may be utilized for military missions.

● Qualified observers estimate France's present air strength to be in the neighborhood of 3500 military aircraft, of which at least 1000 are out-of-date and useful only for limited missions. However, the remaining 2500 fighters, bombers, and observation types represent the latest developments in speed, maneuverability, and armament. A general reorganizing and re-equipping of the French air force is now under way, and stress on numerical superiority has given way to a strong movement emphasizing performance and armament.

Since casualties and obsolescence necessitate replacement each year of about 20% of aircraft in service, there must be a tremendous building program to increase the total air force by an appreciable margin in a short period. In France this problem is especially acute, inasmuch as a large portion of the air force was, a year ago, practically obsolete. Faced with the necessity of re-building, France has lost ground in the European air race to such an extent that Great Britain and perhaps Italy will soon pass her in numerical superiority, based on effective air strength.

The vast capacity of the French factories, many of them now working on 24-hour schedules, will, within a year or so, bring about not only a complete program of re-equipment but also a sizeable increase in the total strength of the French air force. Since the real criterion of air strength lies in the ability of a country to produce planes, it is believed that France's position as an air power is second to none on the European continent.

The various classifications into which the wide range of French military aircraft types may be divided follows:

Fighters: single-place; two-place; multi-place; (combination fighter, bomber, reconnaissance). Estimated number, 1400.

Bombers: (day; night). Estimated number, 900.

Reconnaissance: medium observation—two place; long distance observation—multi-place. Estimated number, 600.

Naval: fighters (shipboard); reconnaissance (flying boat, torpedo bomber, amphibion); miscellaneous types. Estimated number, 600.

France has developed two unusual service aircraft types—namely, the multiplace fighter and the long distance observation. The former is designed primarily to protect the day bomber, but may also be used as a bomber or for long range reconnaissance work. The latter have been evolved for long distance scouting, photographic work, light bombing, and a variety of other similar missions. Unusual stress has been placed on the multi-place fighter-bomber, which is designed for high speed and carries heavy armament. It is believed that loss of maneuverability in this type is more than compensated for by increase in armament. This is especially true for those types mounting the moteur-canon 12Xers 650 hp Hispano-Suiza engine or the 12Yers 860 hp Hispano-Suiza.

The British interceptor type fighter has not been developed in France, having been tried and discarded almost nine years ago. The result of this has been concentration on the development of a single-seat fighter of extreme maneuverability, speed, and armament, and having high rates of climb as well as a ceiling of 36,000 ft. or more coupled with a range of 3 to 5 hours. It appears that the British interceptor fighter is superior only in speed and perhaps in rate of climb and that by a small margin.

Only of late have two-place fighters found favor in France, and as a result the French lag far behind in this category. Due to her decidedly strong single-seat fighters, this weakness is almost imperceptible when the strength of the entire French air force is considered.

Single-Seat Fighters

The Bleriot-Spad 510 is a single bay biplane of all-metal structure covered with fabric. Upper wings have considerable sweepback while the lower are straight. The engine is the Hispano-Suiza 12Xbrs 12-cylinder V, water-cooled, geared, and supercharged. Two fixed machine guns are mounted on the top cowling of the fuselage and are fired through the propeller disc. Two way radio and oxygen equipment are standard. Large quantities of this type are being rushed into service at the present time. It

L'Aeronautique photos

Dewoitine 371

Dewoitine 500

Mureaux 115-R2

has an absolute ceiling of 36,000 ft., and climbs 2800 ft./min.

The Dewoitine D-500 is becoming one of the standard fighters. It is a low-wing, all-metal, cantilever monoplane of monocoque structure throughout. Although a variety of engines are being fitted experimentally to this type, the production model has the 12Xbrs, giving it a rate of climb of 2500 ft./min., and an absolute ceiling of 35,000 ft. The Dewoitine D-510 is the D-500 with the 12Ycrs engine, although its rate of climb is 200 ft./min. better than the latter. Absolute ceiling is identical. The Dewoitine D-371 is a high-wing braced all-metal monoplane with a Gnôme-Rhône Kds 14-cylinder radial air-cooled engine giving an absolute ceiling of 36,000 ft., and climb of 2750 ft./min. Two fixed Chatellerault guns, carried in the wings are fired ouside the propeller disc, and two Vickers are installed on the top cowling to fire through the propeller disc. It is understood that the D-371 is being delivered at the rate of two a day.

The Morane-Saulnier 275 C-1 is a braced parasol monoplane with decided sweepback, but no dihedral, structure throughout being fabric-covered duralumin. Two fixed, synchronized Vickers guns are fitted on the cowling. The engine is a Gnôme-Rhône 9Krse air-cooled radial giving an absolute ceiling of 36,000 ft. and a rate of climb of 2200 ft./min.

The Loire 46 is a semi-cantilever, gull-wing monoplane, multi-gun fighter powered with a Gnôme-Rhône 14Kes. It is equipped with two Oerlikon 20 mm. guns mounted in large fairings at the point of attachment of the lift struts and wings, the empty cartridge cases being ejected through slots in these fairings. Four Chatellerault guns instead of the Oerlikons may be mounted in the wings to fire outside the propeller disc. Performance is extremely good including 3000 ft./min. climb and 38,500 ft. absolute ceiling. This craft is believed to be one of the best of the single-seat fighters.

The Mureaux 170 C-1 is a high-wing braced, all-metal monoplane with a 12Xbrs supercharged 12-cylinder V water-cooled engine. Two Chatellerault machine guns are mounted in streamlined fairings at the point of intersection of the wing bracing struts and the wings. Absolute ceiling is 36,000 ft. and rate of climb 2600 ft./min.

The Nieuport 121 C-1 is a high-wing all-metal braced monoplane with a rate of climb of 2350 ft./min. and an absolute ceiling of 35,000 ft. A Lorraine *Petrel* 12-cylinder V water-cooled supercharged engine supplies power. Two channel guns are located in the wing firing outside the propeller disc. The Nieuport 122 C-1 is similarly constructed except that it mounts a 12Xbrs engine and has 50 ft./min. less climb and 100 ft. less ceiling. The Nieuport 125 C-1 has a 12Ycrs engine and is similar in every other respect to the 121 C-1. Performance shows 2100 ft./min. climb and 33,000 ft. absolute ceiling.

One of the latest experimental models is the Mureaux 190 C-1, a high performance fighter. It is a low-wing cantilever monoplane of all-metal construction, with a new 450 hp Salmson inverted V (supercharged) which is expected to give a maximum speed of more than 300 mph. Armament consists of a canon firing through the engine block and two machine guns in the wing. A range of almost 1000 miles is expected as is a 37,000-ft. ceiling.

TYPE	Max. Speed (mph)	Total HP	Weight Loaded (lbs.)
FIGHTERS (one-place)			
Bleriot-Spad 510	231	500	4000
Dewoitine D-500	231	500	3750
Dewoitine D-510	250	860	4230
Dewoitine D-371	236	900	3700
Morane-Saulnier 275 C-1	226	600	3800
Loire 46	248	945	4300
Mureaux 170 C-1	236	500	3675
Nieuport 121 C-1	229	760	3700
Nieuport 122 C-1	225	655	3600
Nieuport 125 C-1	205	860	4270
FIGHTERS (two-place)			
Mureaux 115 R-2	211	860	5500
Mureaux 180 C-2	236	860	3700
FIGHTERS (multi-place)			
Amiot 142 M	196	1300	15,700
Amiot 143 M	196	1400	15,075
Amiot 144 M	221	1400	15,000
Marcel Bloch 130	235-250	1800	13,500
Potez 54	200	1380	13,000
Breguet 460-M5	240	1650	16,300
Farman F-420	218	1600	15,150

Two-Place Fighters

The Mureaux 115 R-2, a two-seat fighter version of the 113 R-2 reconnaissance, is a high-wing braced monoplane of all-metal construction with a 12Ycrs engine. Rate of climb is 2000 ft./min. and absolute ceiling 35,000 ft.

The Mureaux 180 C-2, also a high-wing, all-metal braced monoplane, is an example of the two-seater fighter derived from a single-seater—in this case the 170 C-1. Both employ the 860 hp Ycrs and the performance of the two-seater is only slightly inferior to that of its predecessor, showing 2300 ft./min. climb, and 36,000 ft. ceiling.

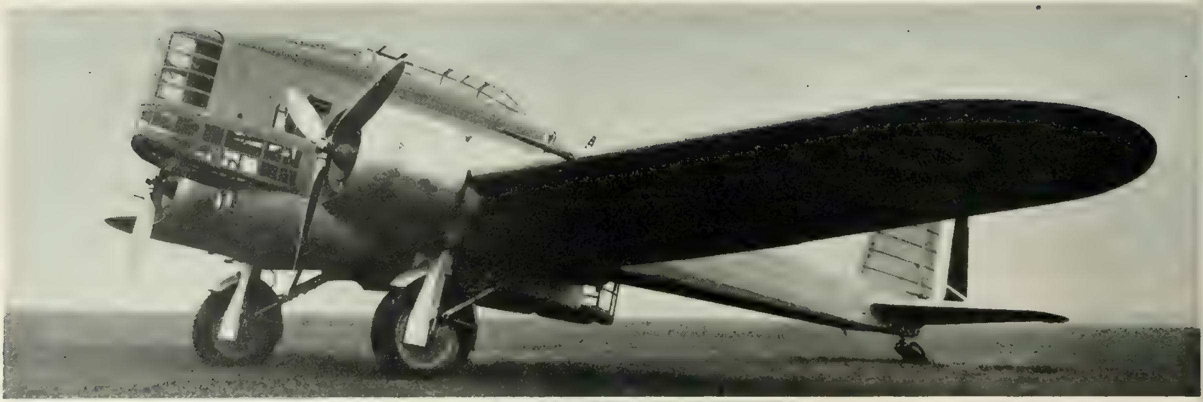
Multi-Place Fighters

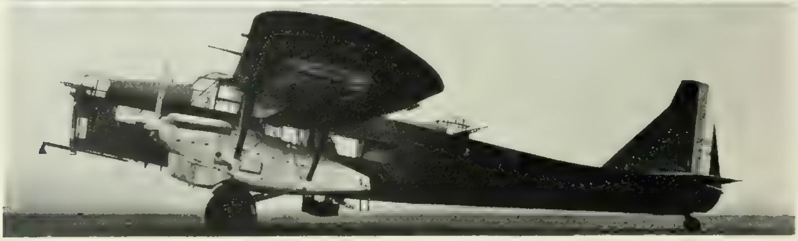
The Amiot 142 M is a cantilever monoplane of all-metal structure with two 12Ybrs geared and supercharged water-cooled engines mounted in the leading edge of the wing. Rate of climb is 1000 ft./min., and absolute ceiling 32,000 ft. An enclosed turret is in the nose of the fuselage for the front gunner, the pilot's cockpit is in front of the leading edge of the wing and a second gunner position is aft of the wing. Directly beneath the pilot is the secondary pilot's position in the

L'Aeronautique photos

Morane-Saulnier 275

Bleriot-Spad 510





The Breguet 460 (above) and the Potez type 54

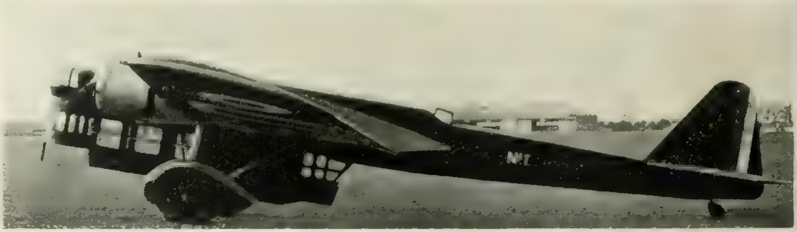
underslung cabin below the fuselage proper. In the front of this cabin is the bomber-navigator's position and a secondary gun station. Aft is a fourth gun firing below the tail. Bomb load is carried both under the wing and inside the underslung cabin. The radio is aft in the lower gunner's position. The three principal positions have twin machine guns, and provision has been made for mounting a 20 or 25 mm. rapid fire gun. The Amiot 143 M is similar to the 142 M, but has two Gnôme-Rhône 14Kdrs radial air-cooled engines instead of the 12Ybrs, although performance is slightly inferior, showing a ceiling of 31,800 ft. and a rate of climb of 940 ft./min. The Amiot 144 M is a modification of the 143 M with retractable undercarriage, smaller wing area, flaps and a slight rearrangement of armament and bomb racks. Performance also is less, with a 30,500-ft. ceiling and 900 ft./min. for rate of climb.

The Marcel Bloch 130 type *Guynemer* is a twin-engined low-wing all-metal cantilever monoplane with radial air-cooled 14Kdrs engines, giving it a climb of 1300 ft./min. and a 33,000 ft. ceiling. A gunner-bomber is in an enclosed turret in the nose, and the pilot is in an enclosed cockpit in front of the leading edge of the wing. Aft of the wing are gunner's positions above and below the fuselage. A bomb load of 2200 pounds may be carried.

The Potez 54 is a typical high-wing, braced, monoplane, twin-engined, multi-seat fighter. Power plant consists of either Hispano-Suiza 12Xbrs, Lorraine *Petrel* 12-cylinder V water-cooled or 14Kdrs radial engines. The regular crew of 4 is carried in positions similar to those of all the planes of this type. The usual bomb load is 2,400 pounds, which may be carried for 700 miles at cruising speed. Unusually complete armament is supplied as well as two-way radio and photographic equipment. Absolute ceiling is 34,000 ft. and climb 1200 ft./min.

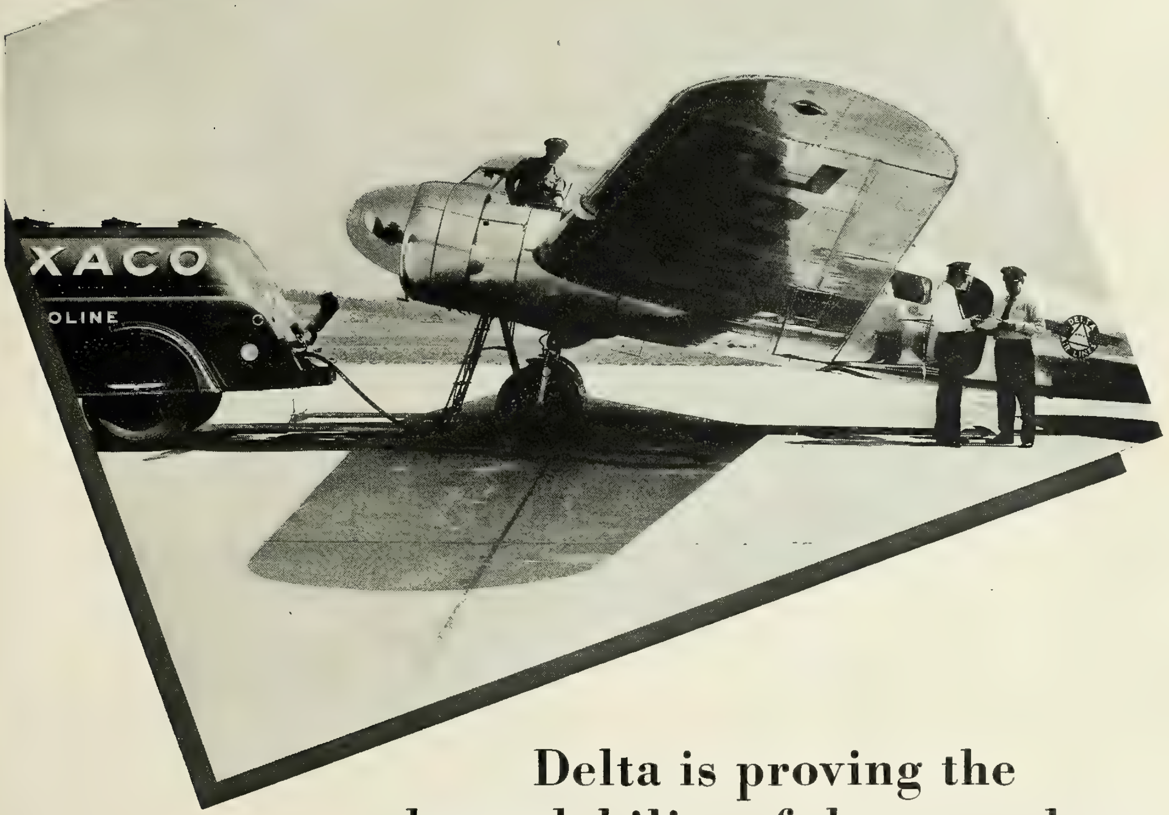
The Breguet 460-M5 is a low-wing, cantilever, metal- and fabric-covered monoplane with two 14Krsd radial air-cooled supercharged engines, giving an absolute ceiling of 36,000 ft. and climb of 700 ft./min. A revolving gun turret is in the nose and below is a navigator and officer's position with transparent panels

(*Continued on page* 58)



The Amiot 143M (right) and the Potez type 54

Better than 99% on Time!



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Thousands of flights have proved to Delta the dependability of Texaco Aviation Gasoline . . . that it is fast starting, quick accelerating, non-detonating . . . powerful.

Delta has proved that Texaco Airplane Oils maintain pressures at high temperatures—reduce wear—and are free from sludge and carbon forming elements.

You, too, can get the same dependable operation with Texaco Products because they were refined especially for aviation use.

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The New RCA Aircraft Radiocompass

A. M. HARNED

● Primarily an instrument of guidance through unfamiliar and off-the-airway routes, the new RCA model AVR-8 radiocompass features accuracy, dependability and versatility in its accomplishments. Economical operation is evidenced by its current consumption (using the plane's 12-volt battery) which is less than that for operating navigation and landing lights. Weight also, has been minimized, 53 lbs. being maximum for the complete installation.

Recognizing the desirability for reducing drag, RCA engineers developed a loop 8 in. in diameter which is enclosed in a true steamline form (called a bomb loop) and presents minimum obstruction to free air flow. Some aircraft construction will permit use of the loop antenna only located within the ship structure and in these few instances the bomb streamline can be disposed of.

Both visual and aural reception is available. The unit is really a 3-in-1 radio aid offering a conventional aural receiver to bring in the beam, broadcasts and weather reports; a radio compass with simultaneous visual course indication and aural reception; and aural reception operating from an electro-statically shielded loop antenna which reduces the possibility of poor reception during those conditions of rain, snow, ice or fog (or even solid overcast) which often cause sets to lose reception. This condition (called rain static) is overcome by switching the operation from visual indicator to vertical antenna and the loop.

Sensitive and selective radio reception is obtained in any of the three bands within the range of the set. The receiver is the single-unit ten-tube superheterodyne type having shielded and filtered circuits and rugged mechanical design. It operates in the radiobeacon-weather band (*X*) from 200 to 410 kcs; in the standard entertainment band (*A*) from 550 to 1500 kcs; and in the high frequency aviation communication band (*B*) from 2200 to 6700 kcs.

AVR-8, or any of the three other combinations produced, may be used as a conventional receiver of aural output for the reception of weather broadcasts or for flying conventional radio range courses; for the reception of standard radio broadcast signals for entertainment and also for the reception of high frequency aviation communication. Switch adjustment of a visual indicator control secures visual operation as a radiocompass for navigational purposes, range being confined only to the *X* and *A* bands since inherent characteristics of the high frequency bands make them unfit for radiocompass use.

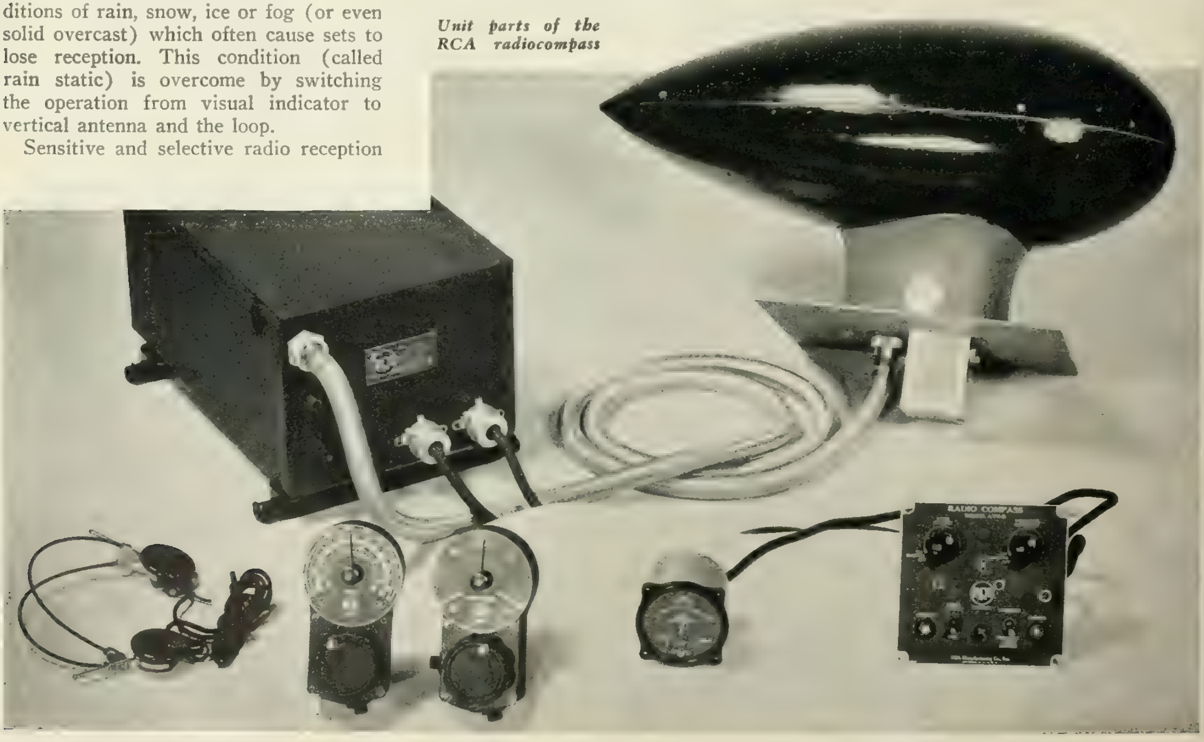
Radiocompass use is neither confined to the narrow path of the beacon nor to points where beacon stations are located. AVR-8 permits the pilot to fly a course toward any selected radio station by following the movements of a visual indicator.

When flying by radiocompass, signals from the beacon stations may be utilized without regard to *on course* signals. The pilot may fly directly to or away from such stations thus eliminating the extra flying usually necessary to get *on course*. If during a flight the *on course* signals are lost the pilot is able to orient himself quickly. He need not resort to dead reckoning. Identification of the sector by aural means, plus bearings toward the station as determined from the magnetic compass and the visual indicator of the radio compass will determine the location of the *on course* signal.

Particularly useful is the provision for reciprocal bearings, which aids flying a true course away from a radio transmitting station as well as directly toward it. It is helpful in flying a course to a point at which there is no radio station by utilizing the signals transmitted from the point of departure or between two points when the distance is so great as to prevent the use of signals originating at the objective by utilizing the reciprocal bearing for a portion of the flight.

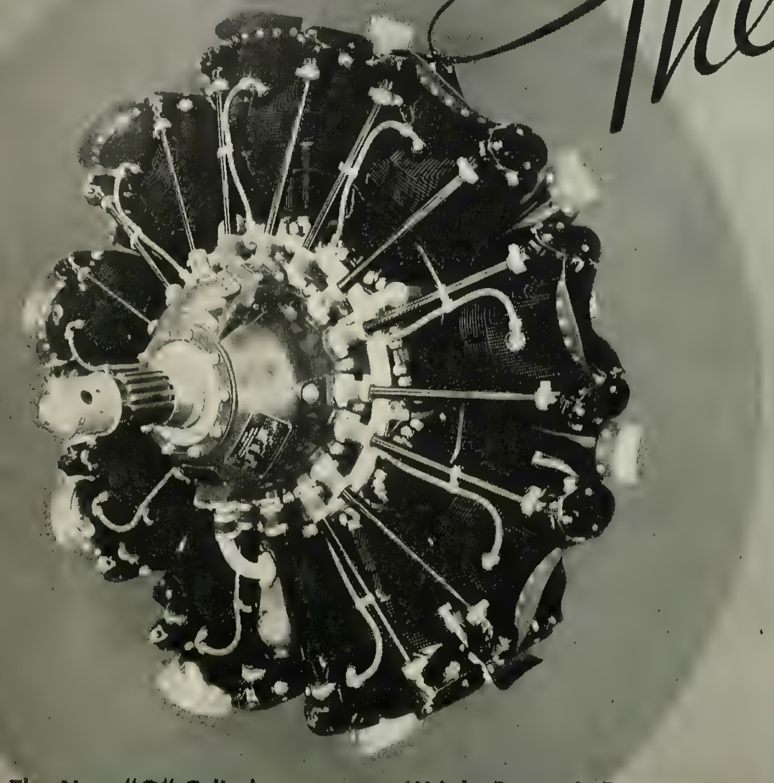
(Continued on following page)

Unit parts of the RCA radiocompass



The 1000 H.P. G CYCLONE

NOW AVAILABLE FOR EXPORT SALE



The new 1000 h.p. Wright Cyclone—the world's most powerful, single-row radial, air-cooled engine in service operation—is now available for export sale!

1000 h.p. for take-off; weight of 1.07 lbs. per horsepower; extremely low fuel consumption of .43 lbs. per brake h.p. hour in the cruising range; new cylinder heads giving 2800 square inches of fin cooling area per cylinder; the dynamic damper eliminating torsional vibration; automatic lubrication of the valve gear—are noteworthy features of the new "G" series of Wright Cyclone engines.

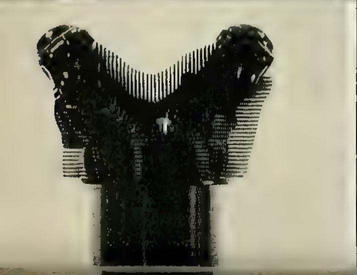
Five thousand Cyclones have been sold during the past 10 years—one thousand in the first 6 months of 1936. The new "G" Cyclones are already in daily service operation on major scheduled air routes in the United States—and earlier models are performing constant, dependable service in commercial and military operations throughout the world.

Intense research in the Wright laboratories has kept the Cyclone continuously in the forefront of world development—forecasting higher horsepower ratings in 1937.

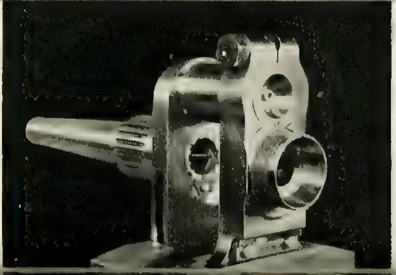
Write for New Catalog Describing the "G" Cyclone

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

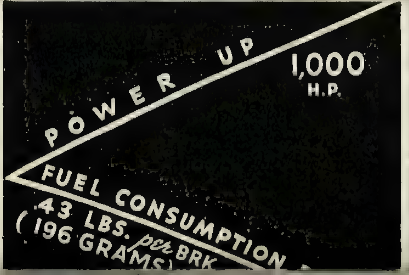
The New "G" Cylinder

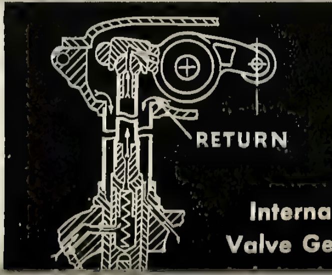


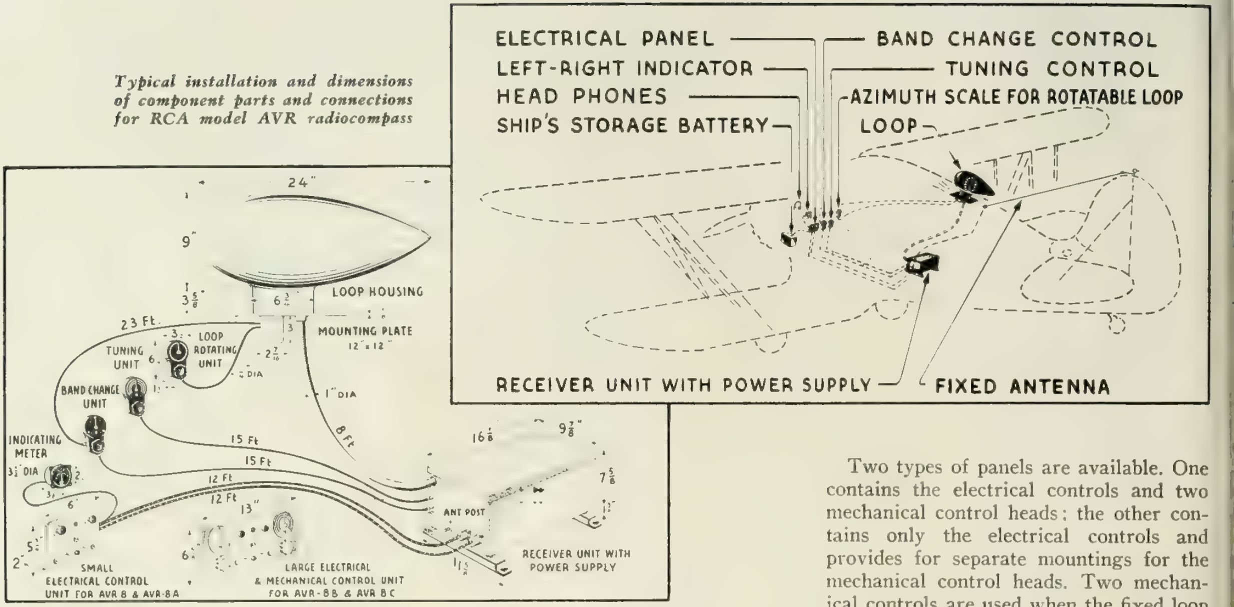
Wright Dynamic Damper



WEIGHT
1.07 LBS.
per
HORSEPOWER







Typical installation and dimensions of component parts and connections for RCA model AVR radiocompass

(*Continued from preceding page*)

Preceding performances are based on the use of AVR-8 as a navigation instrument with a fixed loop. A rotatable loop is available to further provide for determination of the plane's position by cross bearings. The pilot can determine his position by tuning in some station located to one side of his course and then, by rotating the loop until the visual indicator shows zero heading, read its bearing on the loop azimuth scale. This operation is repeated on some other station and by plotting the two reciprocal bearings, the position is at the intersection.

When flying a course to or from a radio range beacon station, reception of weather broadcasts is obtainable while still using the visual indicator, a valuable adjunct when flying by instruments "over the top," and when approaching the immediate vicinity of beacon stations. This is important because in the time necessary for transmission of weather broadcasts it is possible to pass over the station, ordinarily requiring additional flight time for re-orientation. This feature also permits use of broadcast signals for entertainment when flying a course to or from these stations and it also provides a continuous check on the station call letters. Design of AVR-8 also allows separate control of aural and visual output. Therefore, when flying a visual course and aural reception is not needed or desired, audio volume control may be set at minimum without affecting the visual indicator. On very close approach to the station, the visual indicator starts to oscillate, action increasing until the needle swings all the way from right to left, when the airplane is flying directly over the station.

A self-contained plate voltage power supply, using a vibrator type synchronous rectifier with associated filter, is an integral part of the chassis, which is enclosed in a metal case shock-mounted to the aircraft. Finger-operated suitcase type fasteners are used to retain the chassis in the case and serve to clamp down the lid. The chassis may be removed for inspection and servicing by removing the top of the case and sliding the chassis forward. Control connections are made through plugs mounted on its front panel, the controls being equipped with safety locks. Loop and antenna connections are also made on the front panel.

Protection and Accessibility

Component parts have been selected and designed for aircraft service and are treated and impregnated for protection against extreme climatic conditions. The design allows accessibility to parts for servicing and replacement, and the receiver is independent of the loop and control heads, thus eliminating the necessity of removing the entire unit for repair or maintenance.

Fixed and rotatable loops are available, both having the same electrical characteristics, but differing in mechanical construction. Band switching is accomplished at the loop base through a mechanical drive cable. An additional control cable is used on the rotatable loop which is coupled to a rotating unit mounted at the base of the loop and to an additional loop azimuth control head. Connections from the loop to the receiver are made through a 96 in. transmission line, and the assembly is equipped with a plate for mounting to the aircraft structure.

Two types of panels are available. One contains the electrical controls and two mechanical control heads; the other contains only the electrical controls and provides for separate mountings for the mechanical control heads. Two mechanical controls are used when the fixed loop is installed; one is for tuning and one is for band switching. An additional head is required for use with the rotatable loop.

Control heads have been designed with a high gear ratio which affords easy tuning and good resetability. Each head is equipped with a calibrated scale, each band being identified by a distinctive color as well as the band designations *X*, *A*, and *B*. The loop rotating head has a 360° azimuth scale for reading the loop position.

Visual indicator is constructed to withstand shocks and vibrations encountered in aircraft. Calibrated scale and pointer are finished with luminous material, and damping system assures steady and smooth pointer movement throughout the scale. The instrument matches standard aircraft instruments in size and appearance and in usual practice is grouped with flight instruments.

Electrical cables are shielded for reduction of extraneous pickup and are equipped with positive connecting, self-cleaning contact plugs with provisions made for locking. Mechanical cables are of lubricated flexible shafting, each end of the inner shaft being fitted with a screw driver type fitting.

All four models are designed for remote control. The AVR-8 and AVR-8A utilize small electrical panels, band changes, and tuning control heads separated for individual mounting. The former utilizes a fixed loop; the latter a rotatable loop, with loop azimuth. AVR-8B also uses a fixed loop with band change and tuning control heads mounted on large electrical panel for compact localized mounting, while the AVR-8C has a rotatable loop with separate loop azimuth scale and with band change and tuning control heads mounted campactly on a large electrical panel.

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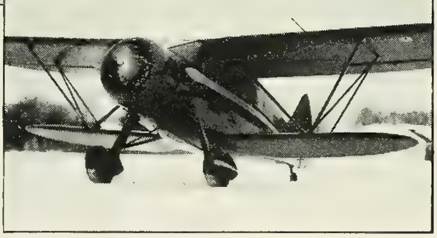
WACO planes are "always on the go" —ready to land here—there—anywhere. Coming down on deserts, slipping into pastures and strange out-of-the-way places are as familiar to them as coasting into smooth city airports.

In fact, landing ability is so important that Waco takes no chances. Time and again Goodrich Airplane Silvertowns are chosen. And it's not just that these tires can take plenty of punishment. Their low pressure construction provides *extra* flexibility. Thus, they instantly adapt themselves to the ground. Bumps and ruts are "ironed out." And because this type of tire has extra-large ground contact area, Silvertowns are SAFER to bring down on snow, sand or mud.

Over 40 Goodrich Products

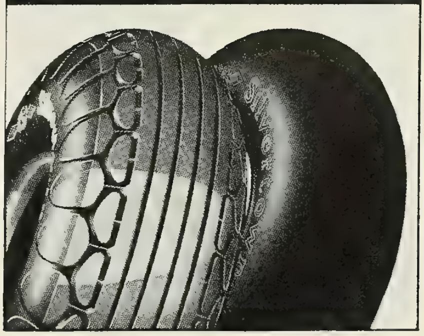
Remember, the same engineering ability that developed the Goodrich Airplane Silvertown — and made it the most universally used airplane tire in the world—has also gone into the making of Goodrich De-Icers, Abrasion Shoes and more than 40 other products. Whether you fly planes for business or pleasure, Goodrich Aviation Equipment will make them safer, more comfortable and more efficient. See your nearest Goodrich dealer without delay or write Dept. 618, Aeronautical Division of the B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and the more than 40 Goodrich Aviation Products.



WACO 4-5 PLACE CABINS, like the C-6 above are luxuriously appointed, noise-proofed, provided with every convenience for comfortable cross-country flight. And all Wacos are ruggedly equipped. In addition to having Goodrich Low Pressure Silvertowns for extra landing safety, Wacos are built with Goodrich Channel Rubber, Grommets, Rubber Cement, Sponge Rubber, Gasoline Hose, and Ventilator Hose.

WACO S-6 —Economical to operate and easy to fly, this 1936 Waco model is the favorite for business travel and charter operation, and *it's Goodrich-equipped.*

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS



Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete line of Rubber Aeronautical Accessories.

Direct Fuel Injection with Spark Ignition

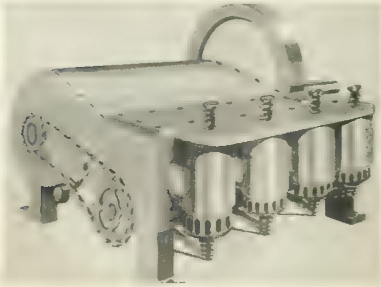
●

GEORGE W. BALL

● The principle of fuel injection directly into the cylinder with spark ignition should be considered as distinct from that of manifold injection, although the mechanical equipment required in both cases is practically identical. It is interesting to note that mechanical metering of the fuel into the intake manifold was used before carburetor development insured reliability. Most early aircraft engines were designed for manifold injection, including those used by the Wright Brothers for their first flights and the early French, 50 hp, 8-cylinder V type Antionette and Levavasseur designs (1906-1908). In these, fuel was deposited in a pocket near the intake valve, being subsequently sprayed into the cylinder by the incoming air. With the carburetor's development, however, mechanical injection was limited to the Diesel engine, because of the natural coordination of the fuel and air flow inherent in the carburetor. In addition, it was a simpler device, devoid of moving parts and easy to manufacture.

Advantages of Injection

Until the present, carburetor development has kept pace with that of aircraft engines. However, with higher powered and supercharged engines, it is probable that the problems of vaporization, distribution between cylinders, and manifold design will become more difficult. Icing in the induction system is difficult to control without application of heat, but if heat is used, volumetric efficiency is adversely affected. It appears reasonable and advantageous to utilize the drop in temperature due to vaporization of the fuel by applying the principle of injection either in the manifold or in the cylinder. If the engine is supercharged, injection into the warmer manifold air insures efficient vaporization. From direct cylinder injection, additional advantages may be gained by lowering the air temperature just before and during compression.



Wright engine of 1903

Recent tests show that the volumetric efficiency and the b.h.p. are increased slightly by direct injection, although other factors being equal, the volumetric efficiency should be about the same because the manifold air temperature is higher. It has been demonstrated that exhaust valves or local hot spots in the combustion chamber can be cooled by directing the spray on or near these parts. Fire hazard can be materially reduced through the use of cylinder injection, as the principle not only eliminates backfire and exhaust flare, but makes possible the use of fuels of low volatility, such as hydrogenated safety fuel, with practically the same thermal efficiency as obtained with gasoline. Starting is simplified when an injection system is used, since each fuel line virtually becomes a priming line on starting, and acceleration should be good. Since the fuel flow is positive, no flat spots should exist if a suitable automatic air throttle control is employed, and in addition, irregularities in fuel flow during maneuvers or inverted flight should be eliminated.

The rate of vaporization of volatile fuels after passing through the carburetor appears dependent upon the temperature of the entering air, that is, the rate decreases with lowering air temperatures. In a radial engine of moderate supercharge, this merely allows more vaporization to take place in the supercharger and diffuser. Consequently, distribution obtained in these engines is not seriously affected. However, if the supercharger entrance passage is poorly designed, it is possible to reach a point where the fuel will not be uniformly distributed in the diffuser by the supercharger and unequal cylinder distribution will result. In the case of unsymmetrical manifolding as used on in-line engines, considerable gain in economy should be possible through better distribution if a suitable injection system is substituted for the carburetor. Intercooling appears to offer a field for further application of injection.

Present Disadvantages

While an injection system has disadvantages, some are minimized because comparatively low fuel injection pressures are used. Other difficulties that may be encountered are: vapor locking tendencies in the injection pump and fuel lines; nozzle dribble; and the difficulty of developing a simple, fully automatic control. By automatic control is meant the maintenance of the required air/fuel ratio at sea level or altitude and all temperatures in the range of operation without continual adjustment of the fuel and air controls.

Recent Development Work

Recent important experimental work in connection with the performance of an injection engine was done at Massachusetts Institute of Technology, first by C. F. Taylor, E. S. Taylor and G. L. Williams (S.A.E. Journal, Mar. 1931). and, in Jan. 1932, by the latter two. The same single cylinder engine was used and the investigations included determination of power, economy, the effect of injection timing on performance, the highest compression ratio possible without detonation, and the effect of using a shrouded intake valve or directed turbulence. Manifold injection characteristics were also investigated.

The results of this work were favorable to direct injection. A special low penetration nozzle was used. Gasoline or safety fuel was used with equally good results and some running was done on Diesel fuel oil. With two-cycle injection timing, better power and economy were obtained on gasoline and safety fuel than with a carburetor. In this work, there was no evidence that a gain in compression ratio could be obtained by virtue of injection in the manifold or cylinder. Operation of the engine was found to be erratic with late injection timing without the shrouded intake valve which indicates the increased turbulence provides greater flexibility in regard to the choice of injection timing.

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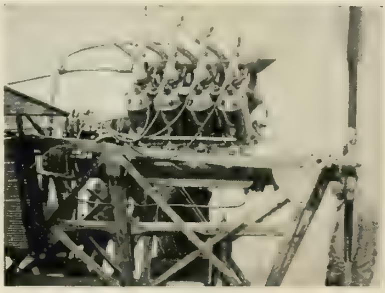

Levavasseur engine of 1906

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(Continued from preceding page)

Two multi-cylinder fuel injection engines were recently tested in a government laboratory. Both were air-cooled, radial types with compression ratios of 5.25 and impeller gear ratios of 7.1 giving normally about 30.0" Hg.—absolute manifold pressure at full throttle at sea level. Power ratings were identical, being 450 b.h.p. at 2100 r.p.m. However, the design of the injection equipment differed considerably. One engine had individual pumps actuated by four cams located in the nose section (hereafter referred to as *A* equipment) while the other employed a multiple pump unit mounted on the generator drive and driven by a single variable lift cam (referred to as *B* equipment). Other differences in the two systems are summarized in Table I.

TABLE I

	A	B
Nozzle type	"closed" pin seat against fuel pressure	"open" lapped pin seat against cylinder pressure
Injection pressure	300#/sq. in.	1000#/sq. in.
Length of fuel tubes	equal	unequal
Fuel pumps	Plungers operate in leather packing	Plungers lapped
Duration of injection	60°	80°
Injection timing-2100 r.p.m.	80° ATC (intake stroke)	130° ATC (intake stroke)
Cut-off	140° ATC	210° ATC
Directed turbulence	No	Shrouded valves
Method of control	Mechanical linkages	Linkages and sylphon
Location of nozzle	Above front spark plug	Center of head

Each engine was subjected to similar 100-hour endurance tests and dynamometer runs to determine reliability, power and economy. Endurance runs revealed relatively little wear in either equipment; very few serious failures occurred, those that did being due entirely to design and not to inherent faults in principle. The power and economy of both engines using gasoline and safety fuel are shown in Table II.

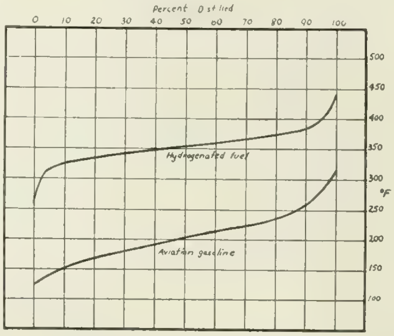
TABLE II

	Carb. Engine	A Equipment		B Equipment	
	Gasoline	Gasoline	Safety Fuel	Gasoline	Safety Fuel
r.p.m.	2100	2100	2100	2100	2100
	495*	517*			
b.h.p. (corr.)	450	485	485	485	480
Best Setting Cons. lbs./bhph.	.485	.525	.65	.495	.532
Mani. Press "Hg. Abs.	30.4	31.2	31.2	33.1	32.9
Press. Drop Throttle "Hg.	3.3	2.4	2.4	0.3	0.3

*Obtainable on the comparable basis of 0.3 "Hg. pressure drop through throttles.

While the power developed was approximately the same, the engine with *B* equipment required 1.9" Hg. higher manifold pressure. This is accounted for by the increase in pressure drop through the shrouded intake valves used to produce directed turbulence in this engine. However, it is to this directed turbulence that the better performance in respect to economy was attributed. In addition, no oil dilution was observed when using safety fuel as was the case with the *A* system. It is probable that the higher injection pressure of 1000 lbs./sq. in. was a contributing factor in the better performance with safety fuel because vaporization was aided by the improved atomization. Idling and accelerating characteristics of the *B* equipment were excellent. The engine could be idled for 10 minutes or more at 400 r.p.m. without any cylinder cutting out, and then accelerated rapidly to rated speed. Also, better distribution was obtained with the *B* system due mainly to the design of the pump unit. Each plunger is actuated by the same portion of a variable cam thus insuring equal strokes for all the plungers.

In contrast to this, *A* pump equipment consisted of individual plungers actuated by trip hammers, the stroke of each plunger being determined by an individual stop and the release by four cams acting consecutively. This design allows greater chance for variation in the stroke of the plungers. However, an advantage possessed by this type of pump is that its characteristics are less affected by changes in speed, consequently the variation of the time and duration of injection is less with changes in engine speed.



Distillation curves of aviation gasoline and hydrogenated fuel

The injection timing of the *B* system varied from 100° ATC to 130° ATC when the engine speed changed from 1000 r.p.m. to 2100 r.p.m. For the same speed range, the timing of the *A* system varied from 66° ATC to 82° ATC or 16° of crank angle. The corresponding durations were 40° at 1000 r.p.m. and 80° at 2100 r.p.m. for the *B* system, and 28° at 1000 r.p.m. and 60° at 2100 r.p.m. for the *A* system. It is probable that the trip hammer pump would be more suitable for two-stroke cycle work because of its short duration and relatively small variation in injection timing. In addition, with this pump, a lower injection pressure should be possible if the nozzle is properly designed. The closed type of nozzle in which the nozzle pin opens toward the combustion chamber was used in the *A* system. The advantages of this nozzle are the elimination of nozzle drip, simple construction and low initial cost. The nozzle pin consisted of a shaft with a ball-end seated in the tip of the nozzle. The spring was set to allow a fuel pressure back of the ball of 300 lbs. before opening was effected. In contrast, the *B* nozzle was of the open type similar to that employed in Diesel practice. The nozzle pin had a 30° pintle and was lapped into a hardened sleeve. The pin was lifted against a spring by the fuel when the pressure reached 1000 lbs. Excellent atomization was obtained with this nozzle but it showed a tendency to drip at the vent due to leakage past the nozzle pin. It is believed that the nozzle pin should be constrained laterally so that uniform sprays are obtained at all speeds. The *A* nozzle pin, in the open position, was pivoted at the spring end and was free to oscillate laterally at the ball-end since the pin was laterally unconstrained throughout its length. This condition could result in non-uniform sprays, especially if carbon or other foreign material should lodge on the ball seat.

Effect on Engine Design

Thus far in America, the practical application of direct injection to aircraft engines has been in models having hemispherical combustion chambers. In other words, the application has been made without any modification of the cylinder head in an effort to improve dispersion, vaporization and subsequent combustion. The decided gain in economy, partly by virtue of directed turbulence, indicates that if the advantages of direct injection

(Continued on following page)

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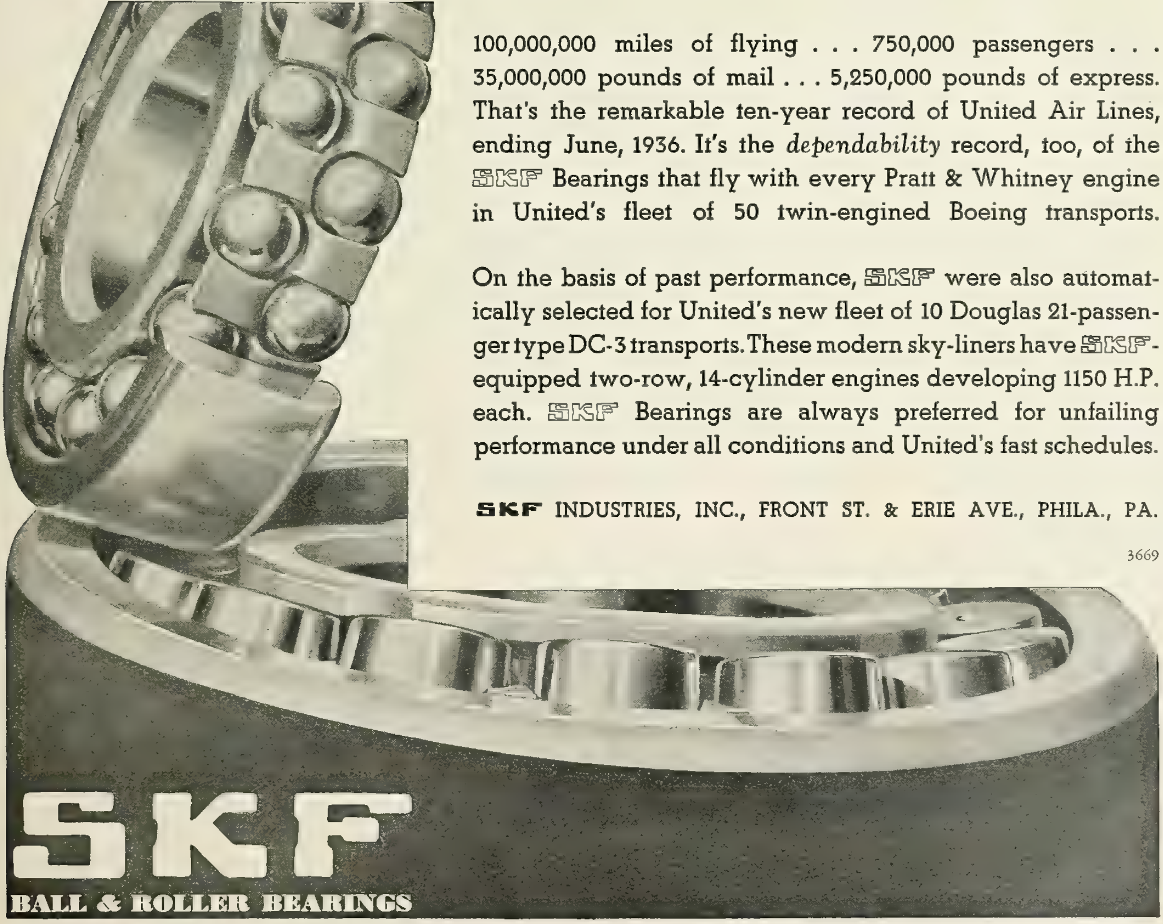

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are to be fully realized the cylinder head will have to be designed specifically for injection. The changes need not be as extensive as would be required for compression ignition, but it is evident that increased turbulence is desirable. The turbulence should be controlled and the nozzle suitably located so that the best distribution or dispersion of the spray will be effected. The results of NACA work with spark ignition fuel injection (NACA Technical Report 471), indicate that a definite field for further experiment lies in determining the possible extension of the practical compression ratio range by such expedients as turbulence, stratification of the mixture, cooling of local hot spots within the cylinder, and the use of safety fuel. An investigation involving so many variables can best be accomplished by the use of the single cylinder engine. Such a projected investigation may be outlined as follows:

(a) Determine the degree and direction of turbulence with respect to all practical locations of the injection nozzle.

(b) Investigate the effects of variation in injection timing and spark advance with respect to the valve timing, and the possibility of using large valve overlap to increase the volumetric efficiency.

(c) Determine the effect on detonation of the cooling effect of the spray on exhaust valves, spark plugs and incoming air.

(d) Investigate the performance with fuels of higher distillation range such as hydrogenated fuels, and the conditions and requirements for starting on these fuels.

(e) Determine the minimum injection pressures and the best spray shape for optimum performance.

From a correlation of the results of such tests, sufficient data should be available to determine the ideal design characteristics such as, the necessary modification of the cylinder head; the compression ratio; the type and location of the injection nozzle, the injection pressure and penetration; injection timing, valve timing and valve overlap; priming requirements, and modifications in the induction or injection system necessary to obtain satisfactory starting on hydrogenated fuels; and type of injection pump and the required characteristics in regard to variation in injection timing and duration with speed.

An engine designed with the conditions and limitations as determined by such tests should have performance characteristics superior to one equipped with a carburetor. Idling and accelerating characteristics must be investigated with a multi-cylinder engine, but considering the results obtained with such engines, little experimenting should be necessary if a satisfactory automatic control can be developed.

Future Development

The trend of aircraft engine design is toward greater power output per cubic inch of piston displacement. The increments so far gained have been effected by increasing engine speed, degree of supercharge, and compression ratio. But each of these expedients is limited either by fuel or engine design. The two-stroke cycle is one means by which the specific output can be increased, and in this field direct injection appears to offer interesting possibilities.

In such an engine, most of the difficulties known to exist inherently in the carburetor version can be eliminated. A two-cycle spark ignition injection engine would not necessarily differ greatly from the four-cycle spark ignition injection engine except that the charging and exhaust events would be completed in half the time. The engine would be supercharged sufficiently to effect satisfactory scavenging and the injection so timed and controlled that no fuel would be lost in the exhaust. The fundamental difficulties with the carburetor version of this type of engine are generally considered to be high fuel consumption, poor idling characteristics and poor cooling. It is reasonable to expect that all but possibly the cooling problem can be practically overcome by the use of direct injection. However, the present inability to cool high specific output two-stroke cycle air-cooled cylinders may be partially overcome by the use of higher compression ratios. This possibility appears to be enhanced through the use of bi-fuel systems or hydrogenated fuels. Also, in this regard, control of the compression temperature and elimination of local hot spots by intelligent location of the spray should be considered.

The development of an Otto cycle engine in the compression ratio range between 8 and 11 would be an interesting addition to our present types, since it would bridge the gap between the high output carburetor engine and the economical compression ignition engine. A hypothesis of such an engine would necessarily involve certain principles of both types. The essential difference is that the compression ignition engine burns its fuel in an excess of air vaporizing it as it burns, while the carburetor engine utilizes its displacement to induct a uniform charge of fuel already vaporized. The processes of cumbustion in both cases are then necessarily different.

In the case of the compression ignition engine, the combustion proceeds upon injection and continues after cut-off until the total charge is burned. The rate of combustion is dependent on several factors, the most important of which is turbulence. Combustion is controlled, and detonation does not ordinarily exist.

In the carburetted engine, detonation appears to be dependent upon the strength of the mixture, the temperature and the pressure. A broad treatment of the subject of detonation cannot be given here, but in general, temperature and pressure limit the practical compression ratio in carburetted engines. As the compression ratio and degree of supercharge is increased the combustion velocity and the tendency toward detonation increases. Ordinarily, the critical velocity or condition accompanying detonation is not attained until most of the charge is burned. Detonation severity is proportional to the percentage of the charge left when the critical state is reached and this type of combustion is uncontrollable. An engine incorporating the principle of spark ignition and controlled combustion may be possible through the use of an injection system supplemented by a carburetor. The amount of fuel introduced by the carburetor would be proportioned so that ice formation would be minimized and the mixture would be lean enough to forestall combustion at high compression ratios. The remaining portion of the fuel charge would then be injected well up on the compression stroke in conjunction with a properly timed spark ignition. The location and direction of the spray would be so chosen that stratification or a combustible mixture around the spark plugs would be obtained. Combustion in such an engine should be controlled since the rate of combustion outside the envelope of the spray would be suppressed by the leanness of the mixture. By employing the proper degree of turbulence, complete combustion would be obtained at the desired time increment. Such an engine should develop a high b.m.e.p. and the economy should be comparable to that obtained in compression ignition engines. A bi-fuel or combination fuel system are among other possible developments.

Liquid cooling of two-cycle engines with cylinders of large size would undoubtedly be necessary but the specific weight of the engine and cooling equipment would be less than a similar four-cycle engine. The idling problem of two-cycle engines is ordinarily a difficult one because of their sensitivity to low manifold pressures as the fuel charge depends upon the air charge to carry it into the cylinder. An injection engine cylinder would obtain its fuel charge independent of the air, and if effective stratification around the spark plugs is obtained, combustion will result whether or not a deficiency of air exists in other parts of the combustion chamber. Consequently, the idling characteristics of a two-cycle injection engine should be similar to that of a four-cycle engine.

Manifold Injection

Manifold injection is a substitute for carburetion that eliminates ice formation, irregularities in fuel flow during maneu-

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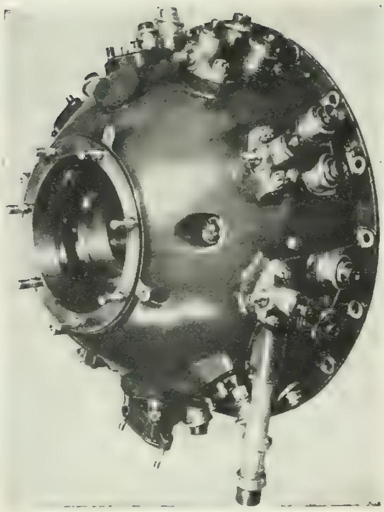


Nose section of fuel injection engine

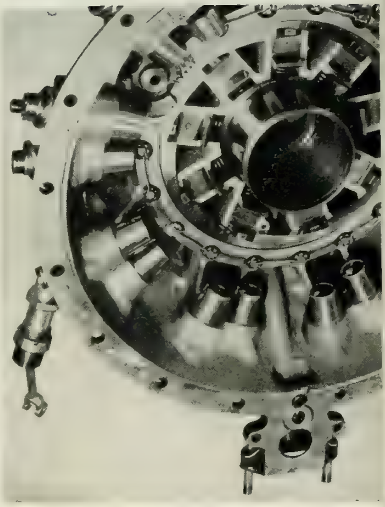
(*Continued from preceding page*)

vers, and in general possesses the same theoretical advantages as direct injection. However, manifold injection requires fine mechanical adjustments and, in a practical sense, does not present the same field for future development that direct injection does. Moreover, performance on hydrogenated fuel is poor because this fuel must be sprayed into an atmosphere of moderately high temperature in order to be vaporized quickly. Aviation gasoline has a distillation range between 120° F. and 320° F. while the corresponding temperature range for safety fuel is between 320° F. and 400° F. Normal manifold air temperatures of supercharged air-cooled engines range between 60° F. and 150° F. while the combustion chamber temperatures probably range between 200° F. and 350° F. Consequently, the most logical source of heat for vaporizing low volatile fuels is in the combustion chamber. A disadvantage of manifold injection, not encountered with direct injection, is the sensitivity of the engine to relatively small changes in injection timing and duration.

Problem of Control

No natural relation between air flow and fuel flow exists in an injection system such as in a carburetor, consequently, the fuel flow is usually controlled by mechanically varying the strokes of the pumps. However, any mechanical system of linkages, manually operated, would have to be adjusted continuously to give the desired air/fuel ratio when the air flow is changed either by changing the throttle position, engine speed, air temperature or altitude. Ordinarily, difficulty in operating with fixed throttle is encountered when leaning the mixture because as speed drops, suction in the intake manifold decreases, thus allowing a greater volumetric efficiency. This results in leaning the mixture proportionately further, leading to instability in operation at or near best setting.

It appears, then, that an automatic means of fuel flow control is essential if the fuel injection system is to be considered as a likely competitor of the carburetor. Such a control should regulate the fuel flow in proportion to the weight of air inducted. A mechanical control for engines operating at or near sea-level is found in the Type A injection system. The air throttle opening and the stroke of the fuel pumps are coordinated by linkages, and provision is made for a manually operated mixture control. This type of control is satisfactory where steady flight conditions prevail such as in air-line operation, but it is unsuited to military work which requires continual changes both in the altitude and throttle position. Partial automatic control is realized in the Type B injection equipment since the air throttle is actuated by a sylphon connected to the manifold. The position of the air throttle is also determined by the position of the master or throttle control, which in turn, controls the fuel pump. In this manner, the air throttle position is determined by two opposing forces, the sylphon and the throttle control lever. However, the air throttle is held in the full open position by positive action of the master control. The set-up is such that any change in engine speed with a fixed throttle control setting results in a shift in the air throttle position so as to maintain a nearly constant air/fuel ratio. As an example of its action, consider the case in which a plane flying with engine at part throttle is put into a dive. The increase in engine speed would ordinarily cause an excessively rich mixture were the air throttle fixed because the fuel charge per stroke would be constant while the air charge per stroke would be less due to increased suction in the manifold. This increased suction, however, would cause the sylphon to open the air throttle until the previous condition prevailed except for some drop in air flow due to friction and lag in the sylphon and linkage.



Injection engine nose section interior

The converse is true if the plane is in a climb. This control also allows flexibility in mixture strength since it eliminates the unstable condition inherent with lean mixtures. On acceleration, it causes the air flow to be momentarily suppressed when the throttle control is first opened because of the sudden increase in manifold pressure. The air flow then follows the engine speed thus insuring a rich mixture during the acceleration period. The acceleration of the Type B injection engine was exceedingly rapid, in fact, structural failures might possibly be expected to result from unwisely ultilizing

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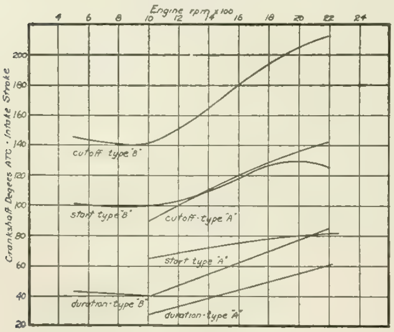
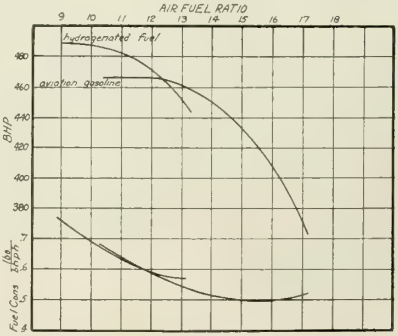
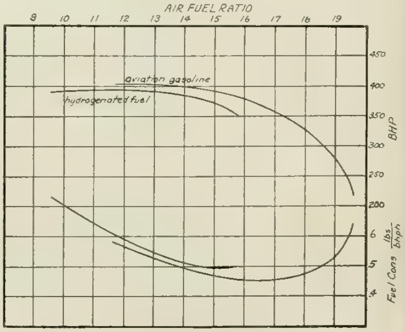


Injection characteristics



Type A, standard intake 2100 r.p.m.



Type B, shrouded intake, 1800 r.p.m.

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A Simple Design Chart for Rivets in Tension Field Webs

JOEL M. JACOBSON

● The accompanying chart provides a rapid means for the design of rivets and web in tension field beams or similar shear webs. Arranged for use with 17-ST aluminum alloy sheets and rivets, the gage of web, rivet diameter, and rivet spacing, may be determined for any shear and, conversely, the strength of any combination may be found. In addition, the "curves" will indicate the critical stress, i.e., whether bearing, rivet shear, or net tension gives the design value. In use, the chart is flexible and can be employed by the engineer to solve any problem in tension field rivet design. Since the curves are actually straight lines, construction of the chart is simple, so that similar graphs for other materials, allowable stresses, or for ordinary plate girder webs may be quickly made. To facilitate such construction, the method used for the chart illustrated is described below.

Design formulas on which the curves are based are:

Bearing

$$V = F_b\,(d/s)\ t/\sqrt{2} \qquad (1)$$

Shear

$$V = \pi F_s\,(d/s)\ d/4\sqrt{2} \qquad (2)$$

Net tension, single row

$$V = F_t\,(1-d/s)\ t/2 \qquad (3)$$

Net tension, double row

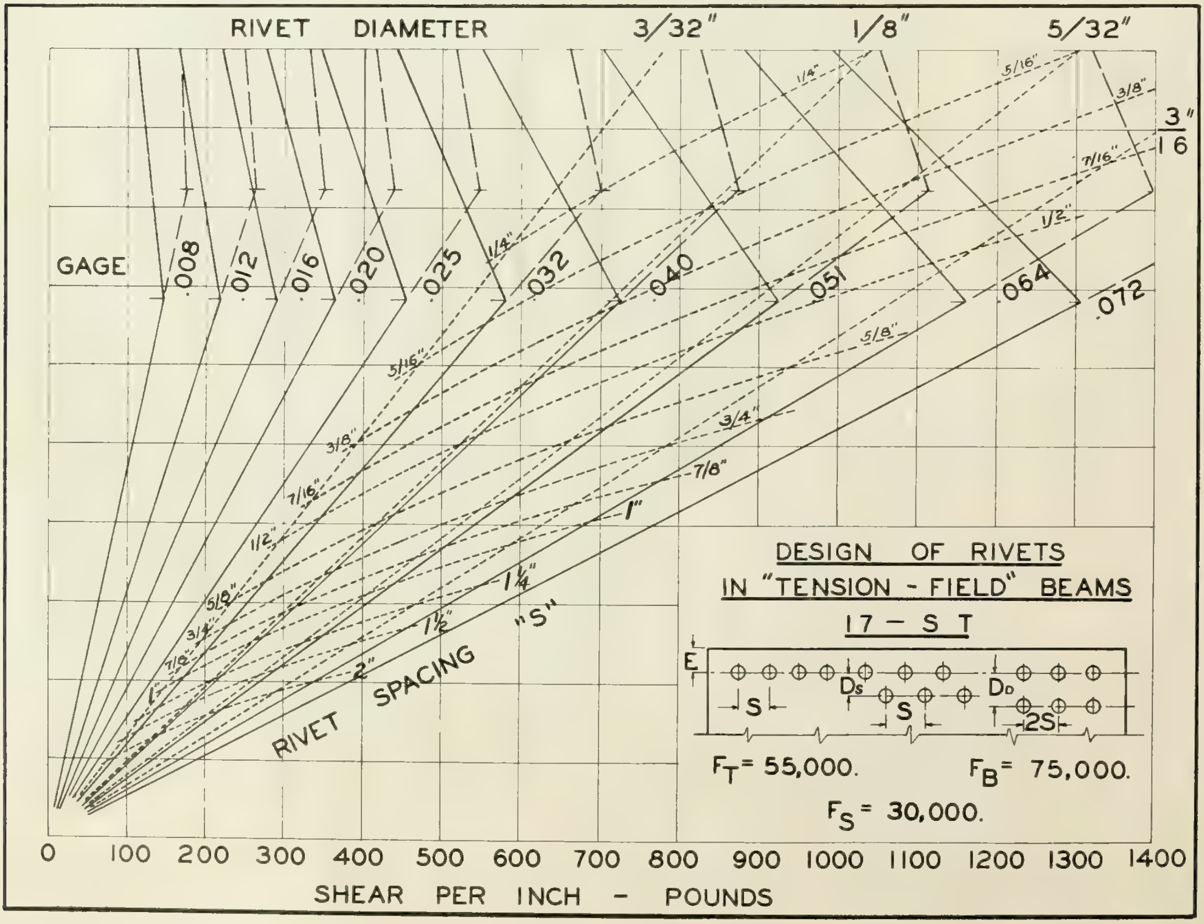
$$V = F_t\,(1-d/2s)\ t/2 \qquad (4)$$

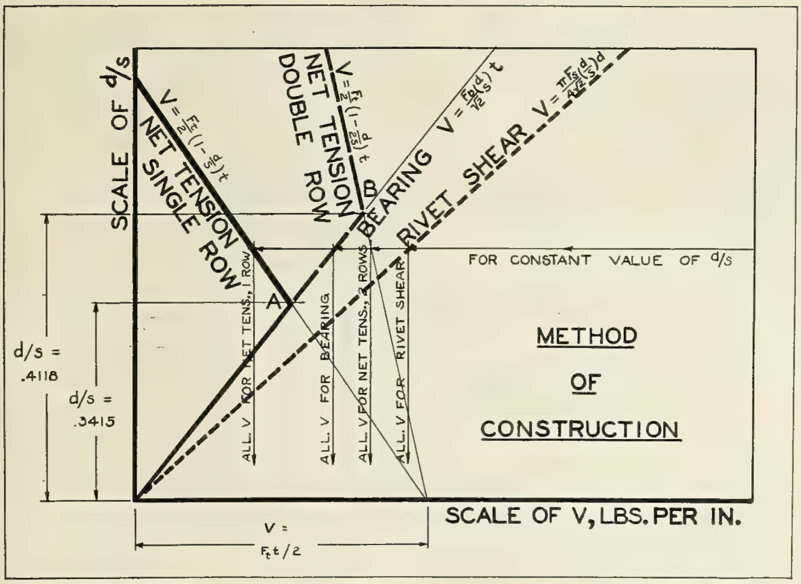
where

V = allowable shear per running inch in web
d = rivet diameter
s = rivet spacing
t = gage of web
F_s = allowable rivet shear stress
F_b = allowable bearing stress
F_t = allowable tension stress

As indicated on the chart, spacing, s, is defined as the length of a section divided by the number of rivets, regardless of pattern. Then the distance between rivets for a double row is actually $2s$.

Equation (1) may be plotted as a family of straight lines radiating from the origin if the parameter d/s is taken as the ordinate. Similarly, equations (3) and (4) will give pairs of straight lines intersecting on the abscissa at a value of $V = F_t\ t/2$. Values of d/s at which the




SCALE OF d/s
$V = \frac{F_t}{2}(1 - \frac{d}{s})t$
NET TENSION SINGLE ROW
$V = \frac{F_t}{2}(1 - \frac{2d}{s})t$
NET TENSION DOUBLE ROW
B
BEARING $V = \frac{F_b}{\sqrt{2}}(\frac{d}{s})t$
RIVET SHEAR $V = \frac{\pi F_s}{4\sqrt{2}}(\frac{d}{s})d$
FOR CONSTANT VALUE OF d/s
A
ALL. V FOR NET TENS., 1 ROW
ALL. V FOR BEARING
ALL. V FOR NET TENS., 2 ROWS
ALL. V FOR RIVET SHEAR
METHOD OF CONSTRUCTION
d/s = .4118
d/s = .3415
$V = F_t t/2$
SCALE OF V, LBS. PER IN.

lines for equations (3) and (4) intersect that for equation (1) will be constant for all values of *t*. For 17-ST aluminum alloy, point *A* is at a value of $d/s = .3415$, and point *B* is at $d/s = .4118$. Portions of the curves to the right of *A* (for a single row) and of *B*, (for a double row) may be eliminated since only the critical (i.e. minimum) value of *V* is desired. For any gage of the web, the allowable shear per inch is therefore dependant only on the *d/s* ratio.

Shear strength for each rivet diameter may be plotted from equation (2), resulting in another family of straight lines radiating from the origin, the dotted lines of the chart. Since a given rivet diameter, and a given value of *d/s* fixes the spacing, a series of even values of *s* may be located along each rivet line and then cross plotted to give lines of equal rivet spacing. The general procedure followed in the construction is illustrated in the diagram above.

The edge distance, *E*, and the distance between rows, *D*, is limited by the shearing (tear out) strength of the web. Assuming that these dimensions should be great enough to provide strength equal to the rivet in shear, and using a shear strength of 27,000. p.s.i. for 17-ST, the minimum values will be approximately as follows:

$E = 2d$
$D_s = 1.5d$ (staggered rows)
$D_u = 2.5d$ (unstaggered rows)

Use of the Chart

A. To Determine the Strength of a Given Combination: Locate the intersection of the known diameter and spacing lines. The shear per inch allowable for rivet shear strength is given directly below this point. Proceed horizontally from the intersection to the gage line, using the solid line for a single row of rivets, the broken line for a double row, then vertically downward to read allowable shear per inch fixed by bearing or net tension. The value determined will be for bearing if the gage line intersection is below the break in the curves, and for tension if above the apex.

Example: web .051; rivets ⅛″ dia.; spacing ½″ double row. At intersection of line for ⅛″ rivets with spacing line of ½″, allowable shear per inch is given as 520.#/″. Moving horizontally to the right to the intersection with the .051 gage line, which occurs below the apex, indicating bearing as the critical condition, the allowable shear per inch is 675#.

B. For Design of Web and Rivets for Known Shear: Proceed vertically upward from the known value of the shear to intersect the gage lines in two points. The thinnest sheet will be the one for which the two intersections show the minimum separation. Draw horizontal lines through the intersections and use any rivet diameter and corresponding spacing to the right of the vertical and enclosed between the two horizontals.

Example: shear = 400#/″. The minimum gage for a single row of rivets is seen to be .025 while .020 may be used with a double row. Assuming a single row of ⅛″ rivets is desired, the spacing will be between 5/16″ and 7/16″, the larger spacing causing the web to be critical in bearing, the smaller, in net tension. For reasons of economy, the larger spacing would be desirable.

Ranger-powered Fairchild "24"

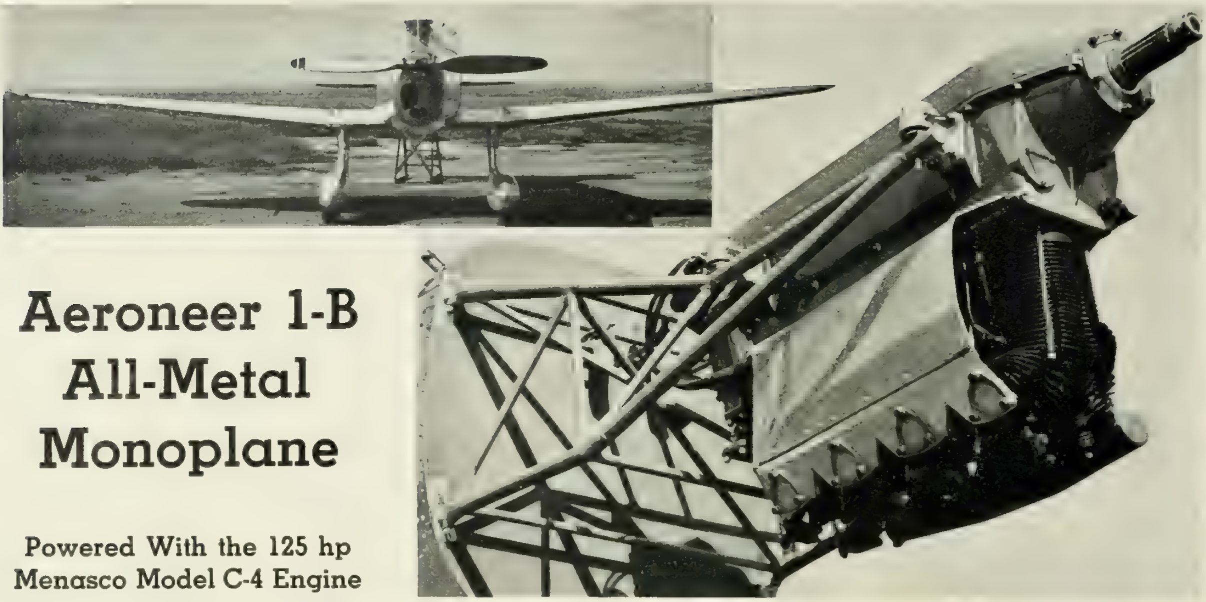
● In general, the Ranger-powered Fairchild "24" for 1936 is similar to last year's Ranger-engined model, except for the refinements which add to take-off, speed and appearance. Wings, tail, fuselage and landing gear are the same as the radial, air-cooled 145 hp Warner-powered "24".

Most noticeable change in the 1936 model is the shape of the cowl enclosing the 145 hp in-line model 6-390-D engine. It is larger in section and more perfectly streamlined than 1935 models, fairing better into the general lines of the ship. Combined with the new windshield, the changes make the nose appear shorter.

Specifications and performance figures of the Ranger-powered Fairchild "24" now being produced at the Hagerstown factory at the rate of four a week, are as follows: empty weight, 1565 lbs.; useful load 835 lbs.; gross weight 2400 lbs.; maximum speed (sea level) 136 mph; cruising speed (3000′) 118 mph; landing speed 45 mph; rate of climb 750 ft./min.; service ceiling 14,420 ft.; and absolute ceiling 17,900 ft.

Performance figures are based on a load of 2150 lbs. under normal atmospheric conditions.

Newest Fairchild "24" powered by the 145 hp Ranger 6-390-D engine



Aeroneer 1-B All-Metal Monoplane

Powered With the 125 hp Menasco Model C-4 Engine

● Aeroneer 1-B has been designed for the private pilot who desires performance, safety and easy maintenance as well as low first cost. Initial product of the Aero Engineering Corp. of Los Angeles, this plane is an all-metal cantilever, low-wing monoplane for two modeled after modern transport design and featuring stability, low landing speed and rugged monocoque construction.

Front end of the fuselage structure incorporates a stainless steel firewall just aft of which are heavy members which carry stresses in the fuselage past the cabin section. These members continue over a station aft of the cabin where they fade out and a skin-stiffener system fades in. Vertical stiffeners used between the two heavy members on each side of the fuselage are so designed that the sides of the fuselage at the cabin section are used as Wagner beams through this section of the fuselage. As this cabin section is not competely metal enclosed, 4 chrome moly tubes are built into the structure to take torsion from the rear of the fuselage down to the wing, also stiffening the structure around the cabin and carrying impact loads in possible noseovers. Stiffener sections are of 24 S-T, as is the fuselage covering.

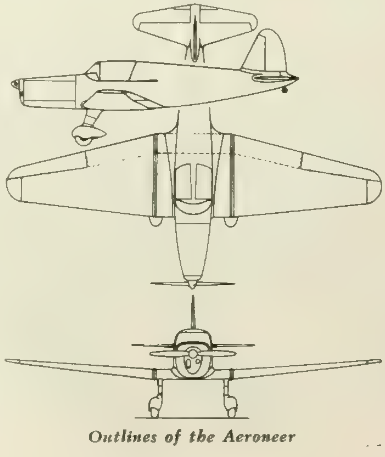
Attention to easy maintenance has resulted in use of a five-section wing, each section independently removable in minimum time. Tip sections are fastened to outer wing panels by bolts and Elastic Stop Nuts and outer wing panels are attached to the center section by attaching angles and bolts. Tip structure is composed of skin and span-wise formers fastening to the rib at the tip of the outer wing panel. Outer wing panels are stiffened skin construction having stiffeners as load-carrying components combined with a beam which takes total shear of wing loads and having heavy sections as beam caps. This beam is designed as a shear field beam with vertical stiffeners as supporting members, according to Wagner's analysis on thin sheet beams. It is located at the 30% point of the chord all along the span of the wing, and its center line is straight from wing tip to wing tip, and perpendicular to the plane of symmetry of the airplane, thus obviating eccentric loads to the loading of this spar. At the 65% point of the chord each place along the wing is a shear carrying member to close off the torsion box formed by the skin covering of the wing section.

Center section follows outer panels in construction and is designed to take landing gear loads. Span-wise stiffeners forward of the main spar on the top of the wing fade out between the joint of the center section and the outer wing panel as they approach the side of the fuselage, due to the fact that there is no top surface structure to the center section inside of the fuselage line, forward of the front spar. Center section fastens of the front spar. Extra members fade in from this joint aft of the front spar to pick up the loads dropped by those members faded out forward of the main spar. These extra members also run under the portion of the center section top surface which is used as a seat, thereby adding rigidity to the structure in the center section and keeping the total margins as high as desired. Center section fastens to the fuselage by a heavy built-up 24 S-T angle riveted both to the top surface and to the lower fore and aft main member in the fuselage in this region. Fuel tanks are carried in this section, aft of the main spar and forward of the shear-carrying rear spar and held up against span-wise channels. This is accomplished by using 24 S-T tension straps tying into the attached flanges by tension bolts in combination with a turn-buckle for tightening.

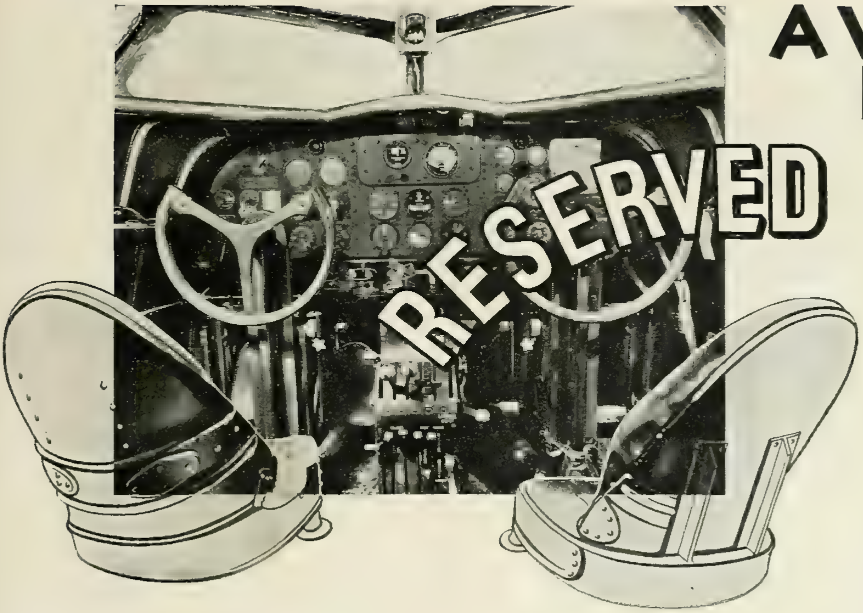
Stringers in the wing structure are doubled up at the inner end of the outer wing panel to eliminate concentrated loads on the attaching flanges. Spar caps on both top and bottom of wing at the joint between the outer wing panel and the center section rivet into doubler plates which also rivet into the attaching flanges which are of 24 S-T.

Ailerons are all-metal Alclad 24 S-T, fabric covered and hinged from the wing by a piano hinge on the top surface extending the full length of the unit. Flap

(Continued on following page)



Outlines of the Aeroneer



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Menasco-powered Aeroneer

(Continued from preceding page)

structure is of Alclad 24 S-T skin and ribs, combined with an integral torque tube, the entire flap containing 25 square feet of area and extending two-thirds of the wing span. Flaps, at the rear and on the lower surface of the outer wing panel, are suspended from the outer wing panel by piano hinges. Flap on the center section is carried on piano hinges and is actuated just inboard of the joint by an irreversible screw and nut mechanism driven from the cabin forward through a control tunnel in the middle of the center section to a crank actuated by the pilot.

Tail surfaces are all-metal 24 S-T cantilever construction, rudder and elevators being fabric covered. Stabilizer's front spar takes shear loads and localized bending loads; rear spar takes total stabilizer bending moments and carries them completely across the structure. Elevators, provided with adjustable trim tabs, are suspended from the stabilizer by piano hinges riveted into a torque-stiff structure which supports elevator ribs, and are dynamically balanced. Elevator tab control is by an irreversible lead screw through miter gear boxes and a torque tube leading to a control crank in the cockpit. Elevator control horn is mounted on a ball-bearing in the center of the fuselage.

Rudder is also dynamically balanced and equipped with a semi-adjustable tab. Rudder torsion is carried to the rudder horn by a built-up square torque tube which is hung on ball-bearing hinges from the rear spar of the vertical fin. Tail cone is formed of aluminum, fastened with bolts and Elastic Stop Nuts to the rear of the fuselage structure and contains a socket to hold a Grimes tail light.

Cabin is provided with side-by-side seats and dual controls. The enclosure is composed of three parts—a fixed Plastacele windshield and two rounded sliding hatches of the same material, one on each side of the fuselage, to provide open or closed arrangement. Hatches operate on fairly loose rollers to prevent binding and may be locked in any position. Control is of the stick type composed of a cross tube and suspended from ball-bearing hinges. The sticks are supported from either end of this cross tube by ball bearings. Sticks are connected by a tension-compression tube running through this cross tube and connected with the stick sockets on either end of ball bearings. Baggage compartment is aft of the cabin extending back into the fuselage. Instruments provided include a tachometer, airspeed indicator, altimeter, oil pressure indicator, oil temperature indicator, fuel pressure gauge, reserve tank fuel gauge, main tank fuel gauge, ignition switch, flap position indicator and aft of the elevator tab control crank handle, a tab position indicator.

Individual landing gear legs mount in a 24 S-T aluminum alloy built up socket, riveted to the top surface of the center section, and also to chord-wise bulkheads fastened to the main spar by tension bolts besides being riveted to the skin along the entire periphery. Construction is of heat-treated steel and its main part is a single tube which takes compression, torsion and bending loads. This main tube also incorporates the oleo-type shock absorber. Differentially acting hydraulic brakes are provided. The tail wheel is fully swivelling through 360° and employs a Goodrich tire mounted on a ball-bearing wheel equipped with a shock absorber. Tail wheel pivots in a steel socket joined to the fuselage by two chrome moly steel legs which resist side loads and allow only relative vertical motion. Vertical motion is restrained by an oleo-shock strut which is built into the structure of the plane. Floats may also be installed without major changes.

Fuel tank system is composed of three components. Main wing tanks are located in the center section on either side of the fuselage and are connected by ⅜" fuel line through a wobble pump to the Evans fuel pump. The auxiliary tank is forward of the instrument panel and aft of the firewall and gravity-feeds fuel to the carburetor, having sufficient capacity for at least 30 minutes continued operation. The outlet to the main tank is aft and at the bottom of the tanks over the top of a water pump, located at the lowest part when the plane is at rest. Fuel lines go forward from this point to a selector valve, ahead of which is mounted a wobble pump, which when necessary, may be used to completely fill the gravity reserve tank.

Power is supplied by the 125 hp Menasco C-4 in-line engine mounted in a chrome moly steel tube mount attached to the fuselage structure at the firewall. Mounting consists of cast dural brackets from the engine to Lord fittings fastened to the mount. In addition to the C-4, the plane has been stressed to take the in-line 95 hp Menasco B-4, 150 hp C-4S, and the 160 hp B-6 engines, without modifications in the cowl and fairing other than replacing the mount and engine controls. Radial engines of similar power also may be used.

Officials of Aero Engineering Corp., are James A. Phillips, Jr., Dr. A. L. Klein, W. C. Rockefeller, Carlos Wood and Milford Childers. Members of the construction staff, in addition to the above include E. G. Ward and Malte Swensson, also officials of the company.

Specifications and full-load performances of the Aeroneer 1-B with the 125 hp Menasco C-4, are as follows:

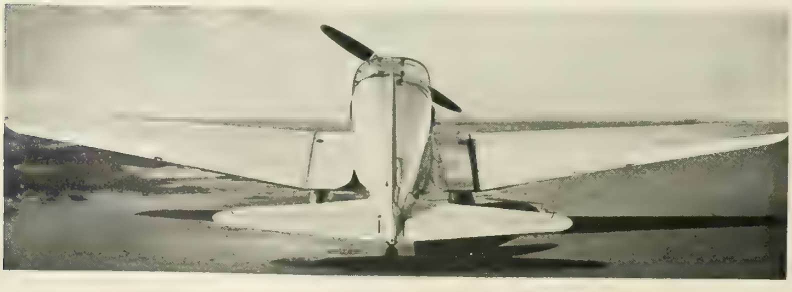
Specifications

Wing span	32 feet 6 inches
Overall length	24 feet
Overall height	7 feet 8 inches
Wing area	168 square feet
Empty weight	1066 pounds
Useful load	734 pounds
Gross weight	1800 pounds
Wing loading	10.7 pounds/ft.^{2}
Power loading	14.4 pounds/hp

Performances

Maximum speed (sea level)	147 mph
Cruising speed (8000 ft.)	138 mph
Landing speed	54 mph
Landing speed (flaps)	46 mph
Rate of climb	750 ft./min.
Service ceiling	15,600 feet
Cruising range	750 miles

Rear view of the Aeroneer



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Digest of Technical Articles from Foreign Publications

Aerodynamics

The Laminar Boundary Layer on the Surface of a Sphere in a Uniform Stream; S. Tomotika, D. Sc., Communicated by Professor G. I. Taylor, F.R.S., Air Ministry (Great Britain); Aeronautical Research Committee Reports and Memoranda No. 1678, *12th July,* 1935.

The report gives the following summary: "A preliminary study on the laminar boundary layer on the surface of a sphere is made, by starting from the momentum integral equation for the boundary layer on a body of revolution. For the velocity distribution just outside the boundary layer, two cases are considered; in one case, the simple theoretical velocity distribution is employed, while, in the other, use is made of an experimental velocity distribution which has been obtained from a pressure distribution found experimentally in the case when the Reynolds Number of the stream is below the critical Reynolds Number of a sphere. In each case various quantities characteristic to the laminar boundary layer are discussed and are shown by appropriate curves."

Experimental Aids

*Study of Airflow Around a Model. Methods of Soap Bubbles. (Etude de L'Ecoulement de L'Air Autour d'une Maquette. Methods des Bulles de Savon, M. H. Vinsonneau, L'Aeronautique, N*204, *Mai* 1936)

The article describes an interesting method of visualizing and photographing flow lines in wind tunnel experiments by using soap bubbles. Unusual stability is claimed for properly formed bubbles which not only cover the experimental chamber but in a number of instances have passed intact through the propeller-fan disc Detailed description is given of the apparatus employed, of the system of displacement, illumination, etc. Practical applications are reported and method of flow photographs suggested. The illustrations give interesting records of various flow patterns obtained by the authors' experiments.

Design

Fighter Aircraft (L'Apparecchio da Caccia, Ten. Col. G. A. Domenico Cosci, Rivista Aeronautica, N6, Giugno 1936)

The article analyzes existing single- and two-seater fighters from the viewpoint of their military applications and design requirements. The following list of contents gives an idea of the ground which the author has covered in this comprehensive paper: armament, use of the cannon, single- and two-seater, requisites and characteristics of fighter aircraft (speed at altitude, rate of climb, ceiling, endurance and range), comparative table of various existing airplanes and a page describing the fighter of the future. As visualized by the author, the characteristics of the future fighter will be: high speed at sea level, about 240 mph; high speed at 13,000 ft., 300 mph; landing speed, 75 mph; climb to 13,000 ft., 6 min.; climb to 20,000 ft., 9 min.; service ceiling, 32,800 ft.; take off and landing distances over a 25 ft. obstacle, less than 1300 ft.

Stratosphere Flying

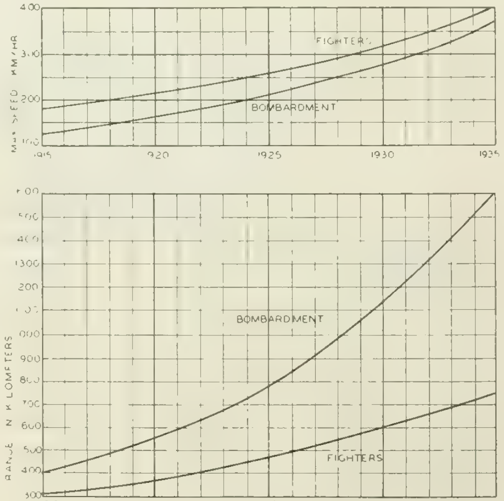
Stratosphere Aircraft, Y. A. Lebedeff, Technic of the Air Fleet, USSR, N5 May 1936

Problem of high altitude flying and particularly the special type of aircraft designed to remain at great heights for a considerable period of time is reviewed. The aerodynamic phase of the problem is discussed briefly, the bulk of the article being devoted to the description of various German, French, Italian and American stratosphere planes either actually constructed or whose tentative design specifications have been published. Most complete data is given for Farman 1001 which crashed during its experimental flight after reaching an altitude of about 34,000 ft. and flying for about three hours at an altitude of 30,000 ft. References given at the end of the article are of interest in view of the scarcity of published data on this subject.

Aerodynamics

Aerodynamic Similitude of Airplanes. Application of the Principle to the Study of Large Aircraft by Means of Small Flying Models. (Similitude Aerodynamique des Avion. Application de la Notion a L'Etude des Appareils des Gross Tonnage au Moyen de Maquettes, Volantes. R. Arsandaux, L'Aeronautique, N 204, *Mai* 1936)

Uncertainties of ordinary wind tunnel investigations and the use of variable density and large tunnels with their attendant high cost prompt the author to analyze and suggest new types of experiments. M. Arsandaux feels that the importance of a large project warrants an extra price for certainty of the expected performance and advances the use of flight testing as the preferable method. The article analyses requirements of aerodynamical similitude, dynamical behavior (constancy of the accelerations) and presents charts and sample calculations substantiating the analysis. He mentions the fact that Short *Scion Senior* is nothing but a flying model of the Short *Empire,* an 18-ton four-engined flying boat destined by the British for trans-Atlantic service. It is an interesting study supplemented by a nomographic chart giving the values of propeller efficiencies, *V/nD,* size, weight and power ratios necessary to obtain aerodynamic similitude.



Charts from "Rivista Aeronautica" illustrating yearly progress in speed and range of fighters and bombers

Specifications

Comparison Between the German Strength Requirements for Aircraft With Those of C.I.N.A.; (Vergleich der Deutschen Festigkeitsvorschriften für Flugzeuge mit denen der C.I.N.A.; Hans W. Kaul und Karl Otto, Luftwissen, Bd3, Nr4, Berlin, April, 1936).

This article is the first part of a comparative study of the German *Specifications for the Strength of Aircraft,* issued in January, 1935, with the requirements of the Commission Internationale de Navigation Aérienne (C.I.N.A.). It is pointed out that increasing foreign sales make this comparison timely and that, in addition, its technical value is obvious. After a brief preamble which sets forth some basic differences, the classification of aircraft is discussed. Chapter 3 is devoted to general definitions and fundamental factors entering into the problem of stress analysis, namely yield point, ultimate load, elastic stability, etc. Chapter 4 treats the wings, setting forth first the C.I.N.A. requirements and then comparing them with German specifications for different cases. The study is complete and gives detailed information on the international requirements with numerous charts and tables from both specifications. The conclusion of the article, which is yet to appear, will treat the stress analyses of the tail surfaces, landing gear, and floats, control surfaces, body and engine mounts.

Pou-du-Ciel

Pou-du-Ciel Verdict. Verdetto sul "Pou-du-Ciel"; Armando Silvestri, L'Industria, Vol. L, N5, Milano, Maggio, 1936.

The Air Ministry of France undertook to investigate the qualities of Henry Mignet's rather famous *Pou-du-Ciel,* and so tests were conducted at Villacoublay by the Air Corps' Flight Section (Commission d'Essai). These were reported by *l'Aero* of April 10. M. Silvestri reviews briefly the expected characteristics of the flivver plane, and its history, and then presents the findings of French military experts. The results indicate that the ceiling of *Pou-du-Ciel* hovers between 1000 and 2000 ft., maximum speed is about 50 mph, with a landing speed of about 40 mph. The plane cannot be flown with a wind of more than 20-25 mph, take-off run is excessive, the engine must be wide open most of the time and, finally, the plane has notable instability at high speed. The only favorable remark made is to the effect that the construction of the plane is simple.

(Continued on following page)

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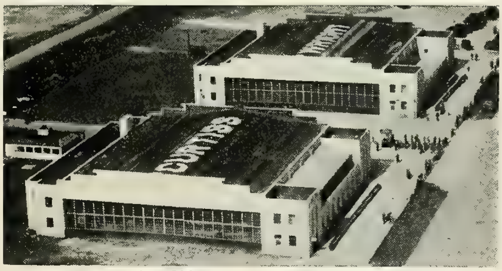

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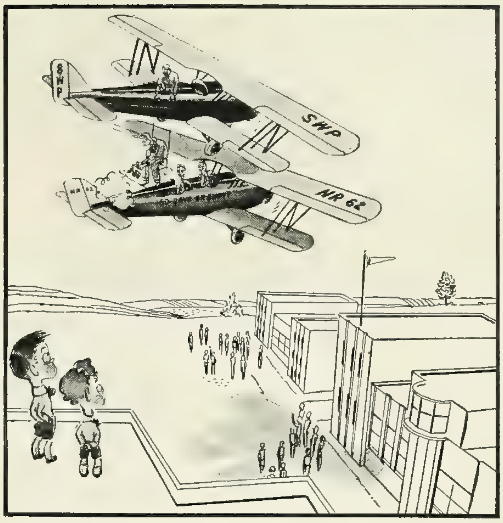

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(*Continued from preceding page*)

Superchargers

Superchargers of Aircraft Engines. (*Les Compresseurs de Moteurs d'Aviation, Roland Barthélémy, Ingénieur A. & M.*)

Power of Supercharged Engines. (*La Puissance des Moteurs a Compresseurs, Basile Marcu, Ingenieur E.N.S.A.*) *Revue Generale de L'Aéronautique, Numero* 20.

The author of the first paper compiles the essential information pertinent to design, functioning and performance of superchargers which are used in conjunction with modern aircraft engines. To simplify and condense the material, mathematical proofs are omitted and only final working design formulas are presented.

The content of this paper includes supercharging, means of supercharging, influence of supercharging on engine power, centrifugal superchargers, Roots superchargers, Rateau turbo-superchargers, and calculation of power of supercharged engines.

The second paper, by Marcu, treats somewhat more in detail the subject of available power of supercharged engines and gives, in addition, a brief outline of published material in connection with the problem of supercharger design and performance.

Wind Tunnel Balance

An Electric Steelyard Balance; Six-Component Balance With Remote Autographic Recording Installed in the New D.V.L Wind Tunnel; Dr. M. Kramer, J.E.W. Guisger and R. Hounsfield Aircraft Engineering, Vol. VIII, No. 88, *June,* 1936.

A description is given of mechanical improvements in the steelyard balance used in the new D.V.L. wind tunnel and wiring diagrams of the electrical remote recording system used in connection with it. The article gives the design conditions imposed upon the designers, the degree of precision achieved, and important mechanical and electrical details of the balance. Drawings accompanying the article illustrate the Jockey nut, drive arrangement, Jockey, electrical control and a remote recording system diagram.

INTERFERENCE

(*Continued from page* 30)

phenomena involved in wing roots can be used to advantage in the re-design of a given wing root.

Suppose that the first set of tapered wing roots were to be physically altered to give a new and thinner airfoil section adjacent to the fuselage without changing chord length. It can be predicted just how this change in airfoil thickness would affect the properties of the lift and drag curves for the first set of tapered wing roots. In the first place, because this airfoil is thinner, there would be naturally by airfoil theory less normal lift and normal pressural drag over it. Its induced drag would also be greater. In the second place, however, its boundary layer would be thinner and consequently there would be less boundary layer interference at the fuselage for a given angle of attack. Following this would be less local advance of breakaway points, less area of deadwater wake, and correspondingly less pressural drag. There would be less local reduction of circulation, less decrease of lift (increased induced lift), and also less increase of induced drag compared with the first set. For the thinner section, the increase of induced lift is greater than the decrease of normal lift, and the corresponding drags are also somewhat less. Since the apparent increase of lift and decrease of drag is for a given angle of attack, it is then obvious that the thinner tapered wing root will reach a higher angle of attack before the breaks in the lift and drag curves appear. This prediction was confirmed by wind tunnel tests by a delay of about 1.5° in the angle of attack at which the breaks appeared. It can furthermore be predicted that the lift-drag ratios will be increased over a large range before the breaks in the curves appear. This prediction was also confirmed by wind tunnel tests.

Many Factors Tested

Many factors influencing tapered wing root efficiencies were tested in these wind tunnel experiments. The more important were found to be: (1) The fore and aft position of the airfoil section adjacent to the fuselage. (2) The chord length as well as the thickness of this section. (3) The contours of the leading and trailing edge tapers. (4) Trailing edge reflexes. (5) The design and angle of incidence of the struts used for bracing the outer wing. incidentally, some favorable "slot action" was at times obtained from these struts. (6) Small fillets at the junction of the wing root and fuselage. (7) Bastard or stub wings inserted into the fuselage near the trailing edge of the wing root to stimulate circulation in that region at high angles of attack.

Space does not permit a detailed discussion of the design of tapered wing roots. It may be said that they show enormous possibilities in the solution of wing fuselage interference for low-wing monoplanes. They are invaluable to certain types of airplanes, particularly the low-wing pusher type, in which the necessary low turbulence of airflow at the wing roots before the propeller can be attained at best by use of tapered wing roots.

The example, chosen at random, need not only apply to tapered wing roots. By such methods similar simple deductions can also be made and used to advantage in the design of other types of wing roots.

FRENCH AIRCRAFT

(*Continued from page* 36)

for downward vision. Pilot and co-pilot's position is behind and above the nose position and is directly over the wing, with the rear gunners located both above and below the fuselage aft of the wing. All gun positions are interconnected with passages.

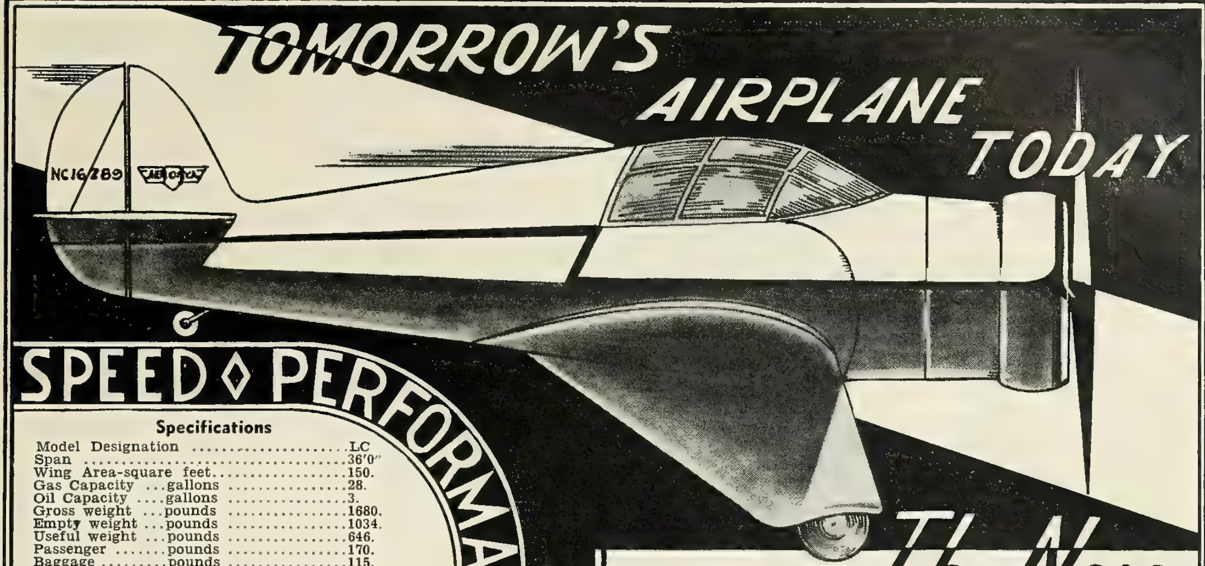
The Farman F-420 is a high-wing, cantilever, all-metal monoplane with two 14Krsd radial engines, one on each side of the fuselage below the wings. In the nose is the usual gunner's position in an enclosed revolving turret. The pilot is also in an enclosed revolving turret in front of the leading edge of the wing. Enclosed gun positions are located above the fuselage aft of the wings as well as in a semi-retractable gun position forward of and below the fuselage. Landing gear is retractable. Absolute ceiling of this type is 25,000 ft., and its climb 900 ft./min.

All of the multi-place fighters are multi-purpose ships, and may be used either for fighting (protecting day bombers), as night bombers, or as reconnaissance (observation) planes. Their armament is almost standard regardless of make. The forward and aft gun positions above and below the fuselage give a tremendous volume and angle of fire. This coupled with high speed and even a small amount of maneuverability makes them an extremely dangerous adversary in combat.

Latest experimental models of the single-seat fighter have unusual performances. The Nieuport 160, a low-wing, cantilever monoplane with the 860 hp Y type Hispano, has a maximum speed of approximately 300 mph. It has wing radiators, enclosed cockpit, and retractable landing gear and tail wheel. It presents a clean appearance and with its two machine guns in the wing in addition to the moteur-canon is an impressive improvement over existing types in the French air force.

The Loire 250 and the Dewoitine D-513 are also low-wing, cantilever monoplanes. The first uses a 14-cylinder 2-row Hispano radial (the 79 Ha) of more than 1000 hp and carries two 20 mm. quick firing canons, as well as 2 small calibre machine guns, all mounted in the wing. The Dewoitine 513 is armed similarly to the Nieuport 160 and has a maxmium speed of 298 mph at 16,000 ft. Climb is in excess of 2,400 ft./min. and absolute ceiling is rated at 37,500 ft. The Loire 250 is a bit faster and has a maximum speed of 310 mph with a landing speed of 65 mph obtained by the use of split flaps. This fighter has been said to have climbed to 16,500 ft. in less than 5 minutes. All three of these new fighters have such features as single spar wings, trailing edge flaps, retractable landing gear (including tail wheel), enclosed cockpits far aft on the fuselage, internally braced structure and exceptionally clean aerodynamic design.

(*To be continued in September*)



SPEED ◇ PERFORMANCE

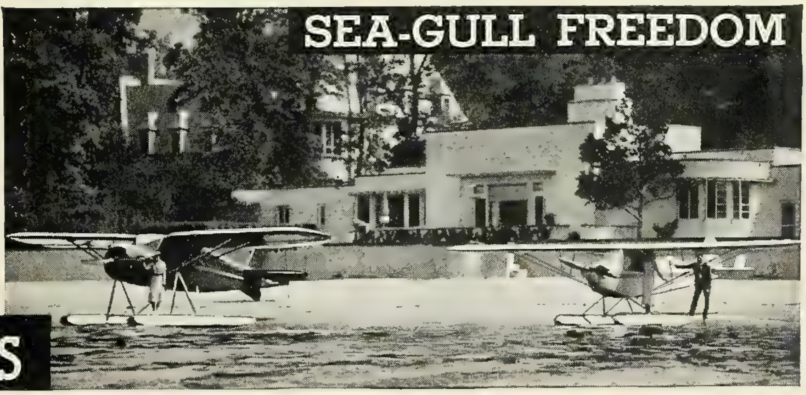
Specifications

Model Designation	LC
Span	36'0"
Wing Area-square feet	150.
Gas Capacity ...gallons	28.
Oil Capacity ....gallons	3.
Gross weight ...pounds	1680.
Empty weight ...pounds	1034.
Useful weight ...pounds	646.
Passenger ....pounds	170.
Baggage ....pounds	115.
Wing Loading ...pounds per sq. ft.	11.2
Power Loading...pounds per sq. ft.	18.65
Maximum speed at sea level...M.P.H.	123.
Cruising speed at 90% R.P.M....M.P.H.	109.
Landing speed at gross weight...M.P.M.	48.
Landing speed at min. weight...M.P.H.	42.
Climb in feet—1st minute	650.
Service Ceiling—feet	16500.
Cruising range....miles	540.

Aeronautical Corporation of America
Lunken Airport, Cincinnati, Ohio

STYLE ◇ COMFORT

The New
WARNER POWERED
AERONCA



★ Go anywhere that water is found. Depart from your own float or beach, alight directly at your friend's lake, stream or bay—these are your landing-fields with EDO Float gear. You will enjoy a freedom, a convenience, you haven't known before. Homes, clubs, beaches that once were awkward to get to, now will seem "just around the corner." Write for full particulars about EDO Floats—interchangeable with wheel landing gear, standard for all popular makes of planes.

EDO Aircraft Corporation
630 2nd St., College Pt., L. I., N. Y.

EDO FLOATS

Yes!

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SECURE IMMEDIATE EMPLOYMENT

Nelson S. Riley, Jr., of Wichita, Kansas, says: **Your broad scope of work in airplane design, drafting, aerodynamics and structure were the greatest value to me on my first job in boosting me ahead of other young men who started at the same time... For any one who wants to learn aeronautical engineering quickly and thoroughly ... I highly recomment your practical school.**

CHOOSE
CURTISS-WRIGHT
SEE PAGE 8+9

INCREASE YOUR PAYLOAD WITH BERRYLOID ZINC CHROMATE PRIMER P-27!

● Take on *extra* payload and boost your flying profits! Berryloid Zinc Chromate Primer P-27—new light-weight surfacer adds 12 to 15 pounds to your plane's lifting capacity! Unusually anti-corrosive, too—fights costly rust—saves money! Write for latest booklet on P-27. Address:

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PAINTS • VARNISHES • ENAMELS • LACQUERS
DETROIT, MICHIGAN ★ WALKERVILLE, ONT.

Recent Aeronautical Patents

● The following recent patents of interest to readers of Aero Digest were compiled from the Official Gazette of the United States Patent Office.

Supercharger for internal combustion engines. Samuel R. Puffer, Saugus, Mass., assignor to General Electric Co. (2,042,550)

Pitot static tube. Charles H. Colvin, Morristown, N. J., assignor to Pioneer Instrument Co. (2,042,700)

Camera. Harry C. Fairchild, Elizabethton, Tenn. (2,042,983)

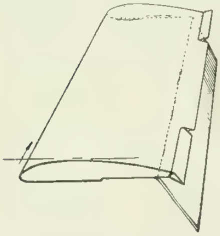
Signal control apparatus. Morris F. Ketay, Brooklyn, N. Y., assignor to Bendix Aviation Corp. (2,043,000)

Combined gyro-compass and artificial horizon. Clinton H. Havill, South Orange, N. J., assignor to Eclipse Aviation Corp. (2,043,168)

Air-cooled engine. Jean Heinrich, Paris, France, assignor to Societe des Moteurs Salmson. (2,043,170)

Apparatus for dispensing liquids from airplanes. Nicholas E. Oglesby, Troy, N. Y.; Sebastian W. Kessler, Perth Amboy, N. J., and Adlai H. Gilkeson, Montgomery, Ala. (2,043,262)

Split flap. Fred E. Weick, Langley Field, Va. (2,043,275)



Device for locating the position of a movable body (navigation instrument). Hjalmar E. Sjostrand, Ravala, Grangesberg, Sweden. (2,043,336)

Method of and apparatus for securing propeller blades to the hub. Reinhard Krissiep, Frankfort-on-the-Main, and Werner Linicus, Dusseldorf, Germany, assignors to American Lurgi Corp., New York, N. Y. (2,043,481)

Internal combustion engine. Walter F. Davis, Farmingdale, N. Y., assignor to Fairchild Aviation Corp. (2,043,529)

Aircraft. Glen E. McPherren, San Diego, Calif. (2,043,704)

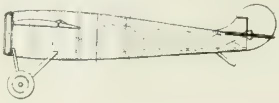
Direction indicating device. Joseph Bell, Cincinnati, Ohio. (2,043,727)

Landing indicator for airports. Arthur M. Wilhelm, Randolph, N. Y. (2,043,847)

Aluminum welding rod. Fred Keller, New Kensington, Pa., assignor to Aluminum Corporation of America. (2,043,855)

Process of welding material. Paul D. Field, Akron, Ohio, assignor to Goodyear-Zeppelin Corp. (2,043,952)

Fuselage construction. Giuseppe M. Bellanca, New Castle, Del. (2,043,980)



Air navigation apparatus. James Anthony McNally, U. S. Navy. (2,044,009)

Flare. Samuel Wiley, Metuchen, N. J. (2,044,024)

Gun mount. Edward C. Wells, Seattle, Wash., assignor to Boeing Aircraft Co. (2,044,036)

Airplane. Rex W. Sinquefield, St. Louis, Mo., assignor of one-half to Ernest M. Crosby. (2,044,108)

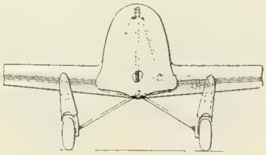
Internal combustion engine. Lionel M. Woolson (deceased) by Emma F. Woolson, executrix, Bloomfield Village, Mich., assignor to Packard Motor Car Co. (2,044,113)

Artificial horizon. Bert G. Carlson, Queens Village, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,044,150)

Artificial horizon. Elmer A. Sperry, Jr., Brooklyn; Bert G. Carlson, and Mortimer F. Bates, Brooklyn, assignors to Sperry Gyroscope Co., Inc. (2,044,151)

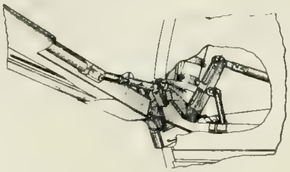
Method of manufacturing propellers, and propeller. Alfred A. Handler, Cleveland, Ohio, assignor to Aluminum Company of America. (2,044,293, 2,044,294 and 2,044,295)

Retractable landing gear. Colby W. Stewart, Manchester, Conn., assignor to Curtiss Aeroplane & Motor Corp. (2,044,338)



Gun installation and firing means. Clem G. Trimbach, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,044,340)

Aileron control for folding wings. John A. Kerr, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,044,357)



Solder for aluminum. Ralph B. Derr and Conral C. Callis, Oakmont, Pa., assignors to Aluminum Company of America. (2,044,671)

High frequency collecting and radiating structure. Malcolm P. Hanson, Bethesda, Md. (2,044,779)

Radio direction finding. Edward Joseph Hefele, Lindenhurst, N. Y., assignor to Airplane & Marine Direction Finder Co. (2,044,789)

Projectile. James G. Taylor, Dayton, Ohio. (2,044,819)

Gyroscopic compass. Leslie F. Carter, Leonia, N. J., assignor by mesne assignments to Sperry Products, Inc. (2,044,899)

Aircraft with aerodynamically rotatable wings. Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Company of America. (2,045,051)

Altimeter for aircraft, and method and means for measuring altitude of aircraft. Lloyd Espenschied, Kew Gardens, N. Y., assignor to American Telephone & Telegraph Co. (2,045,071 and 2,045,072)

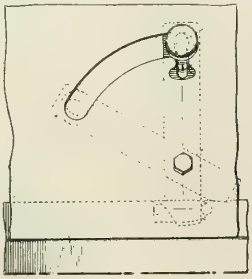
Propeller for aircraft. Kurt F. J. Kirsten and Herbert M. Heuver, Seattle, Wash. (2,045,233)

Aileron control system for airplanes. Wesley Blake Henderson, Cuba, Ill. (2,045,269)

Pitch differential means for lifting propellers. Russell R. Hays, Encinitas, Calif. (2,045,355)

Induction system for internal combustion engines. William Helmore and Alan Arnold Griffith, Hampshire, England, assignors to H. M. Hobson (Aircraft & Motor) Components, Ltd. (2,045,389)

Cowl fastener. La Vergne Cook, Dayton, Ohio. (2,045,583)



Airplane. Randolph F. Hall, Rochester, N. Y. (2,045,463)

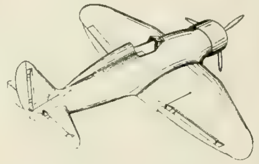
Wind direction indicator. Andor de Hertelendy, Budapest, Hungary. (2,045,521)

Hoisting apparatus. John C. Smaltz, New York, N. Y., assignor to McKiernan-Terry Corp. (2,045,533)

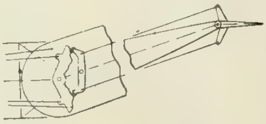
Automatic level control for aircraft. Bert G. Carlson, Bellerose, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,045,579)

Aircraft. Edward Burke Wilford, Merion, Pa. (2,045,623)

Means to assist movement of airplane control surfaces. Etienne Dormoy, Seattle, Wash., assignor to Boeing Aircraft Co. (2,045,638)



Trimming and balancing flap for aircraft. Robert J. Minshall, Seattle, and Ralph L. Cram, Seahurst Park, Wash., assignors to Boeing Airplane Co. (2,045,667)



Skywriting apparatus. Glen H. Morey, Bartlesville, Okla., assignor to Phillips Petroleum Co. (2,045,865)

Radio beacon. John Magarry Furnival, Purley, and William Frederick Bubb, Mitcham, England, assignors to Radio Corporation of America. (2,045,904)

Directional aerial system. Ernest Green, Penrose, Long Stomps, Chelmsford, England, assignor to Radio Corporation of America. (2,045,987)

Starting device for internal combustion engines, and air and fuel chamber for engine starters. Charles F. Heywood, Detroit, Mich., assginor by mesne assignments to Eclipse Aviation Corp. (2,046,073 and 2,046,074)

Muffler for aircraft. Frank P. Davis, Hileah, Fla., assignor of one-half to Joseph H. Walsh, Jacksonville, Fla. (2,046,252)

Parachute assemblage. Samuel H. Knight, Lancaster, Pa. (2,046,387)

PERFORMANCE ⋆ SAFETY ⋆ APPEARANCE ⋆ ECONOMY ⋆ LOW FIRST COST

SUPER-PERFORMANCE of the Warner Powered PORTERFIELD DeLuxe airplane, which climbs more than 1,000 feet per minute fully loaded, has astounded hundreds of pilots who have seen this outstanding airplane demonstrated over the country. They are astonished at the low price of $2795, completely equipped.

AND EASY TO BUY

A year ago PORTERFIELD airplanes with LeBlond 70 engines showed a new yardstick of comparison and performance heretofore unknown with 70 horsepower. The price of the new DeLuxe powered plane with the improved LeBlond Model E70 horsepower engine—only $2095—is making new friends for this craft. The same airplane with the Velie engine at $1795 is an exceptional value.

In September PORTERFIELD will announce a fourth model, decidedly the lowest priced airplane ever offered to the American public—a two seater, which operates for 45¢ for 75 miles flying.

PORTERFIELD also announces the best *safety record* ever made by any production model airplane.

These exceptionally safe airplanes may be purchased for one-third down. They are manufactured by craftsmen who have been building airplanes for PORTERFIELD for from seven to ten years. Workmanship, we believe, is as important a factor as the high grade materials which are used in the construction of PORTERFIELD products.

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FINANCE YOUR AIRPLANE

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In answer to the demand for financing of aircraft, the Aviation Credit Corp. (of St. Louis) has been organized to give to the aviation industry the same advantages of deferred payment purchases that are now enjoyed by the automotive trade. ¶ Rates are reasonable. ¶ Contracts are drawn without recourse to seller, whether seller be an individual or a dealer. We take the responsibility for the collection of all payments and seller receives cash payment by air mail the minute the deferred payment contract is accepted by us. ¶ This company is entirely an aviation enterprise, designed to meet the needs of the aviation industry. ¶ In addition to the financing of new and used aircraft, we will finance repairs to your ship, acquisition of new equipment such as blind flying instruments, night flying equipment, parachutes, etc. ¶ You can increase your sales by using our services. ¶ Write us immediately for rate cards and a sample contract. ¶ *Airplane dealers and distributors write for our Contract.*

AVIATION CREDIT CORP. (of St. Louis, Mo.)

LAMBERT FIELD ST. LOUIS, MISSOURI

EQUIPMENT and METHODS

Vertical Lift Fire Door

Cornell Iron Works have developed for large openings, a self-closing vertical lift fire door with controlled operating speed and which can be instantly reset after an emergency closing. This door was designed for the U. S. Navy for an aircraft factory, but is adapted to hangars, or any location where large self-closing doors are used. It has been built to a size of 60′ × 20′ and can be manufactured to practically any dimensions.

The door section may be of tin-clad wood, structural steel covered with asbestos or any standard fireproof construction. It has a wide lap at lintel and jambs and has tight-closing steel fire-stops. In operation, the door, partially balanced by a counterweight, slides vertically between guides so designed that no amount of heat expansion can cause sticking. Operation is by one or more oil cylinders with piston rods connected to the door or counterweight and supplied with oil by a motor driven pump. The system is closed and under pressure so that the door cannot close until the valves are properly operated. For emergency closing, the melting of a fusible link opens a release valve permitting the door to close but holding its closing speed to any desired rate. Resetting this valve restores the door to normal operation.

Sextant for Aircraft Use

Fairchild Aerial Camera Corp., has developed the Hagner Position Finder, a navigation instrument which automatically and quickly solves the spherical triangle, and with which it is possible to secure a fix in less than two minutes. To use the instrument, the observer needs only the Nautical Almanac and a clock giving Greenwich civil time.

Invented by F. C. Hagner, the finder is a small compact instrument which may be held in one hand during an observation, leaving the other free for adjustments, or it may be placed on a gimbal for operation. Considered a miniature celestial sphere, it consists principally of a horizon plane, declination, latitude and altitude arcs, and hour angle circle. The horizon plane carries the altitude arc, azimuth circle and a spherical level bubble.

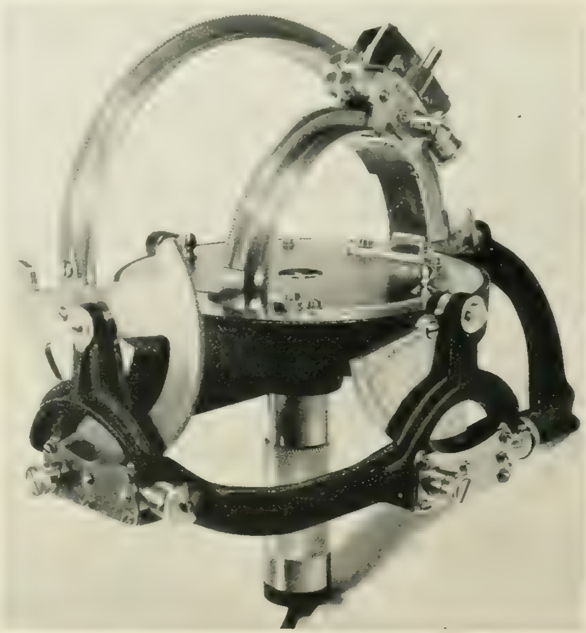
In the center of the bubble mounting is a ⅛" diameter circle which is the geometrical center of the instrument and corresponds to the observer's position on the Earth when making an observation on a celestial body. The graduated azimuth circle rotates inside of the horizon circle which, when the instrument is properly set, gives the azimuth of any heavenly body sighted.

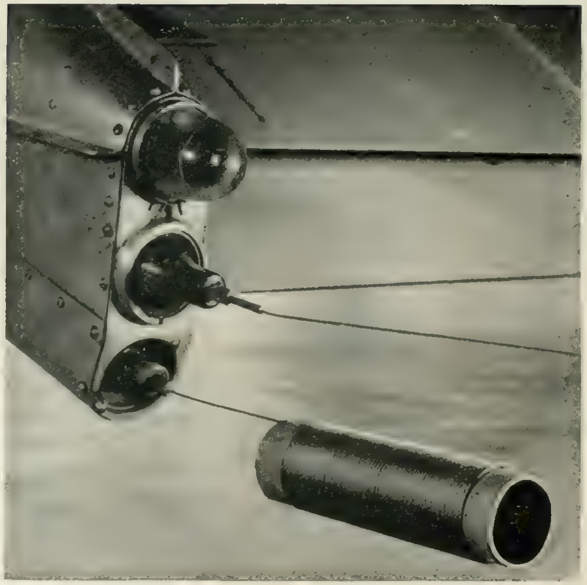
The declination arc is graduated in degrees and pivoted at the North and South poles of the finder frame. Thus, when the declination of the observed body is set on the circle the motion of the body across the heavens can be followed by rotating this arc. By reading the hour angle circle which indicates the angular position, the exact longitude can be determined.

The latitude arc gives part of the horizon plane and is always perpendicular to it, the exact latitude of the place of observation being read directly from the graduated arc when proper settings are made. At noon when the sun is at the Zenith, the plane of the declination arc and the plane of the latitude arc are the same.

The altitude arc is mounted on the horizon circle in a plane perpendicular to it. When the position finder is properly sighted, the observed altitude of any body can be read directly.

Hagner Position Finder





Trailing auxiliary radio antenna

Auxiliary Antenna

Development of an auxiliary radio antenna to supplement the standard trailing antenna for simultaneous or independent use has been completed in the maintenance department of TWA, Inc.

If the regular antenna is not providing desired reception or transmission, the auxiliary unit can be released and shot out into space for simultaneous use. A switch throws the auxiliary antenna in parallel with the regular antenna and it may be used in this manner without affecting signal strength of the transmitter or reception of the 2-way receiver. While operating on day frequency, the unit increases signals from the transmitter.

To permit installation of this auxiliary antenna, it was necessary to design a new casting to house the portable unit. Being directly beneath the regular unit, it alters the tail cone's shape.

The entire unit, including the casting, weighs between 4 and 5 lbs. It consists of a cylinder with a compression spring and trigger. There also is an electrical switching mechanism, which, when loaded with the antenna cartridge and released by an Arens control, ejects the cartridge and closes the electric switch putting the auxiliary antenna into immediate use. When the control is released, a compression spring forces out a cardboard cylinder upon which is wrapped 35 ft. of #16 steel control cable which serves as the antenna wire. This wire ravels to discard the cardboard tube, which is held in place against the compression spring by the trigger.

(*Continued on following page*)

Yes!

CURTISS-WRIGHT GRADUATES SECURE IMMEDIATE EMPLOYMENT

P. M. Zee, of Shanghai, China, says: You will be pleased to hear that I have made a start with Central Aircraft Manufacturing Company and thank you most cordially for your great kindness in giving me such a splendid recommendation. Once again I must congratulate you on your engineering course, for your students need not hesitate to entrust their future with you.

CHOOSE **CURTISS-WRIGHT** SEE PAGE 8+9

THE PURITY of Kendall Oil, protected against dust, dirt or contamination by special refinery-sealed cans, is brought to you in perfect condition. Refined 100% from Bradford Pennsylvania Crude. You can get it at most airports throughout the country.

KENDALL REFINING COMPANY · BRADFORD, PA.

Yes!

CURTISS-WRIGHT GRADUATES SECURE IMMEDIATE EMPLOYMENT

W. B. Berry, of Butte, Montana, says: Through your placement service I was given a position at the Douglas Aircraft Company the day after graduation, climaxing a wonderful experience. My health in Montana had always been bad, so my parents urged me to attend Curtiss-Wright. The warm California sunshine and daily walks I got from the nearby private home where I had a comfortable room and three wholesome meals a day for $30 a month, gave me the best health I ever had.

CHOOSE **CURTISS-WRIGHT** SEE PAGE 8+9

BABB AIRCRAFT SALES

International Aircraft Brokerage
U. S. Export License No. 124

ENGINES

CYCLONES, New, Model SR1820-F2, 735 H.P. List price $8120; net each	$6000
CYCLONE, Model SR1820-F52, 820 H.P. Same as new. List price $8600; net	6000
CYCLONE, Model SR1820-F1, 650 H.P. Practically new	3000
HORNETS, Model 1860B, geared, 575 H.P. 38 hours total time. Each	1000
HORNETS, Model 1860B, direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each	1650
HORNETS, Model 1690A, 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each	1000
WASP SC1's—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each	1650
WASP C's—420 H.P. Under 500 total hours; overhauled and modified. Each	1350
WASP B's—420 H.P. Under 600 total hours; overhauled and modified. Each	850
WRIGHT R975-A's, with D modifications—330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each	1250
WRIGHT R760-E's—250 H.P. Majored and modified by Wright distributors. Each	1250
WRIGHT J-5—220 H.P. 593 total hours, standard cylinders, majored—like new	450
LYCOMING R-680—215 H.P. Majored and modified by Lycoming distributors	550
KINNER C-5—210 H.P. Under 400 total hours; majored and modified	450
KINNER R-5—160 H.P. Few total hours—like new	950
KINNER B-5—125 H.P. Newest type: factory rebuilt, with new engine guarantee	950

Following Engines in "As Is" Condition
All average under 500 total hours.

No.	Type	Price Each
27	**HORNET** A-1's—525 H.P.	$ 500
18	**HORNET** B's—575 H.P.	850
25	**WRIGHT** R975's—330 H.P.	675
40	**CURTISS** D-12's—400 H.P.	500
18	**CURTISS** CONQUERORS—600 H.P.	500
3	**AXELSONS**—150 H.P. 7 cylinder, air cooled	150
1	**CHALLENGER**—185 H.P.	195

AIRPLANES

Aeroncas, Boeing, Curtiss-Wright, Eaglerocks, Fairchilds, Fleets, Fleetsters, Fords, Bellancas, Lockheeds, Pitcairns, Northrops, Stearmans, Stinsons, Travel Airs and others.

SPECIAL
While They Last!

New, genuine Wright J-6 Exhaust Valves, each	**$12.50**
J-5 Exhaust Valve Guides, standards, each	**1.50**
J-5 Exhaust Valve Guides, plus ten, each	**3.00**

Engine parts—new and used—for Wasp and Wright engines at big discounts. Write for bulletin on bargains.

CHARLES H. BABB
GRAND CENTRAL AIR TERMINAL **GLENDALE, CALIF.**

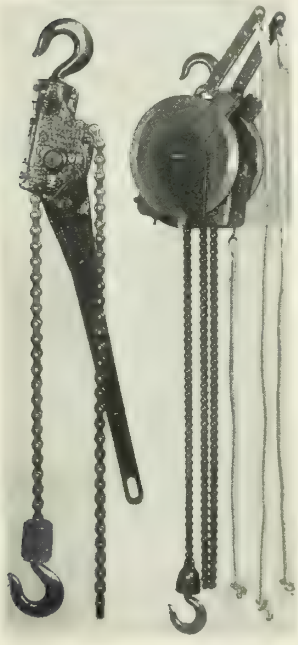
(Continued from preceding page)

Chain Hoists

A new line of spur gear, twin power, gravity lowering chain hoists has been developed by Coffing Hoist Co. of Danville, Ill.

Particularly adaptable for aircraft use, they can be utilized for lifting engines, propellers, and other heavy parts of an airplane, in addition to lifting the plane itself when it is necessary to test landing gears.

Ranging in capacity from 500 to 4000 lbs., the hoists include twin levers, with a rope pull, operating on the face of disc wheels by a friction grip, thus eliminating the need for a hand chain to lift the load. A governor controls the speed when loads are lowered.



Coffing chain hoists

When there is no weight on the hoist, slack in the load chain can be taken up by pulling the loose end of the chain, or the chain can be pulled out free for adjustment by releasing the clutch.

Aircraft Receiver

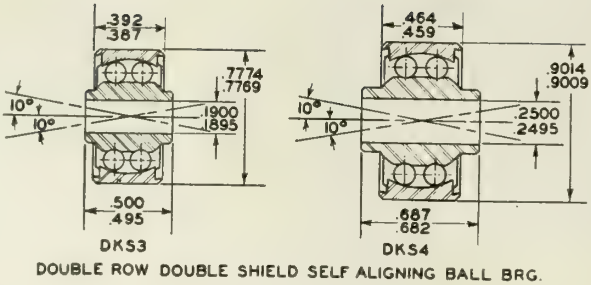
A small light-weight radio receiver for aircraft, known as Western Electric 20 type, allows convenient installations in small planes and provides the private pilot with reception in the beacon, broadcast and short-wave bands employed for communication with ground stations. If desired, a remote control unit is mounted on or near the instrument panel, a flexible cable connecting the remote control unit with the receiver and permitting installation of the latter in some out-of-the-way corner of the plane. Conventional controls can be mounted directly on the front panel within easy reach of the pilot.

The superheterodyne receiver has four separate frequency bands—200-400 kc. for beacon and weather stations; 550-1500 kc. for commercial broadcasts; 1500-4000 kc. for aircraft, police and amateur communications; and 4000-10,000 kc. for aircraft, amateur communications and foreign broadcasts.

Output is 700 milliwatts, sufficient to operate six sets of headphones simultaneously. Crystal-controlled reception in either or both of the high-frequency bands may be employed, and for this purpose a two-frequency crystal control unit can be incorporated in the receiver. One of the crystals may be used in each of the high-frequency bands, or both may be employed in the same band.

The varistor (a device for reducing loud static crashes when receiving weak signals) and the automatic control is normally used except for beacon reception, where it might interfere with the performance of the receiver for course indication.

Including tubes, spot-welded chassis, and shock-absorbing rubber mountings the receiver weighs 14.75 lbs. It measures 9" × 14.62" × 8.25" and has been built to withstand aircraft operating conditions.



Two types of Fafnir bearings

Self-Aligning Bearings

A new group of ball bearings which combine internal self-alignment with double grease-shield protection has been introduced by the Fafnir Bearing Co.

Developed primarily to meet requirements of the aircraft industry, the bearings are of the double-row type. Two rows of balls operate on a spherical race surface on the outer ring to provide inherent self-alignment for shaft misalignment up to 10°. The double metal shields are joined to the outer ring, and maintain a minute but constant clearance from the inner ring at any position of self-alignment.

As in other Fafnir bearings of the doube-shield type, the new units are supplied pre-packed with lubricant. Rings and balls are of SAE 52100 steel, and rings are cadmium plated on exposed surfaces for corrosion resistance.

The two bearings of this type now available from stock are shown on the diagrammatic sketch. The DKS-3 has 24 ⅛" balls, a static radial non-brinell capacity of 900 lbs. and a static thrust non-brinell capacity of 190 lbs. Capacities for the larger DKS-4 which has 30 ⅛" balls are 1100 lbs. and 240 lbs. respectively.

Air Conditioning Transport Planes

Mechanical refrigerators have solved the problem of air conditioning airliners while they are on the ground. Applicable to the needs of the air transport industry, these units are portable, quick in action, and can be used either to heat or cool the plane to desired temperatures.

One of the newest types is the Lipman refrigerating and air conditioning device developed by General Refrigeration Corp., Beloit, Wis., and at present used by American Airlines and TWA. Its lower section consists of a hold-over tank, insulated for heating or cooling. In this tank are steam coils or electrical resistance for heating its contents for winter service, and icing coils for summer service.

In the summer, water is used, but when steam heating is required in winter, an anti-freeze solution is utilized in the tank. Liquid is circulated through the coils to be either cooled or heated, and a high pressure blower fan delivers conditioned air through a flexible tube directly into the plane or to the inlet of its ventilating system. A damper regulates the quantity of air delivered through the unit heat exchanger, and if desired this can be automatically operated from a portable thermostat in the plane.

A refrigerating machine is connected to icing coils so that a mass of ice can be frozen in the tank. This machine may be run at any time when the unit is not being used for cooling purposes. Ice produced while the conditioner is in operation cools the water circulated through the unit heat exchanger, and is sufficient to cool the air for precooling several planes.

Refrigerating machine is of the air-cooled type, using Freon-12 as refrigerant. Due to automatic control, the refrigeration cycle is completed without manual adjustment. Power is supplied through a cable attached between the control panel in the unit and electrical outlets in the hangar or on the field.

When cooling or heating service is not required, the truck is parked near conveniently accessible electric power and plug-in connections are made to the electric line. In winter, this allows heating the water or other solution in the tank; in summer it is used to build up an ice or cold water supply. When a plane lands on the field and air conditioning is required, these plug-in connections are broken and the truck is driven near the plane. The 5 in. air tube is then connected to the port hole in the ventilating system and the heated or cooled filtered air is blown through the cabin.

Lipman air conditioner cooling the cabin of a Douglas DST

WHY

from the very beginning has HASKELITE been used by these prominent manufacturers

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DOUGLAS FAIRCHILD
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and a number of others

?

because-

Haskelite can make panels of any size or thickness, to pass any government test for plywood. Haskelite is splendidly fitted to do this, since it has by long odds the longest experience, the largest number of presses, the most capable engineering staff, and the greatest amount of equipment.

Haskelite has played so prominent a part in the introduction of the new types of resin glue now being used. Since the very beginning of the aircraft industry, Haskelite has been foremost in the development of the glues used in waterproof plywood.

Haskelite can meet the special needs of any airplane manufacturer. All he needs to do is to describe the specifications, and tell what purpose is to be served by the paneling he wants, and—if anyone can make it—Haskelite will turn out the job. Haskelite developed soundproofing paneling. Haskelite developed fire-resistant paneling. Haskelite developed the metal-clad plywood called Plymetl.

Haskelite design tables, weight tables and structural value tables of different plywoods in different combinations are available for the asking.

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*Name*____________ *Age*______
*Years in High School*______ *Years in College*______
*Address*____________ *Phone*______
*City*____________ *State*______

Personairlities

By Caldwell

● W. Leigh Brintnell, President of Mackenzie Air Service, Ltd., of Edmonton, Alberta, and points North, is a cool and collected Canadian—cooled by many flights to the Arctic Circle and finally collected by a young lady from Virginia. Leigh was born in Belleville, Ontario, in 1895, and successfully remained a bachelor for more than forty years, galloping gaily over the Western plains and the tundra of the Far North, and browsing on the tender shoots of the buffalo grass and on wild berries, especially juniper berries, distilled. He had escaped the snares of local Dianas for so long that his associates began to call him the Lone Ranger, when this young lady from Virginia, who comes of an old hunting family in those parts, went to Canada determined to bag either a moose or a Canadian, she didn't care which. She bowled the Lone Ranger over with ease, and now he's just as tame as the rest of us.

He flew down to New York recently in his new Noorduyn *Norseman,* and as I had heard much about him and his flying in the Northern mineral areas of Canada I naturally expected to meet a bird who resembled Dangerous Dan McGrew. Instead, he drank one beer and called it a day, remarking that his favorite beverage really was milk. He's a medium sized fellow, with shoulders so wide that he has to go sideways through doors: in a rough and tumble with a grizzly bear it would be an even bet which one would have to call for help first. Leigh developed his muscles when a boy by carrying Canadian game, such as moose and elk, back to camp. He's very, very healthy, like most Canadians. He tells me that in Great Bear Lake the trout run up to sixty pounds. Those are the only ones Leigh lands; any under that he throws back to give them a chance to grow up. When fishing in Great Slave Lake, he says, it is the custom to bait the hook with a whole ham. Only the big fish have mouths large enough to take that bait, so the fisherman is not annoyed with little bits of trout weighing only twenty pounds or so. It's a very healthy place, even for fish.

In summer the North country is infested with bull-dog flies and American sportsmen. A bull-dog will light on you anywhere and bite a chunk of meat right out of you, and an American sportsman will fill you full of lead as quick as look at you, mistaking you for a moose when you may be only a visiting Elk from Kansas City. Canadian paper mills have been experiencing difficulty with their pulp wood recently—when they'd put it in the mill ponds it would sink. It turned out that the wood was full of lead bullets, evidently fired at local *fauna* by visiting sportsmen. The Mackenzie Air Service has flown numerous hunting parties to the sub-Arctic for big game hunting—one party from Chicago came in equipped with machine guns. Several well-known sportsmen return each year, if they don't get shot by other sportsmen the previous year. One chap last season made the whole Northwest Territories his hunting grounds, covering thousands of miles of country with his party in Brintnell's ships. They'd alight some place, fire off all their guns, terrify the animals for miles around, and then fly off to an unscared area. Two moose and a guide had nervous breakdowns. This went on for weeks, until all the ammunition and whiskey was gone, when the party returned to the States. These are the sort of people who may be expected to vote the straight Democratic ticket next November—them and Bill Nye.

Toting hunting parties around is only a small side-line with Mackenzie Air Service. Their biggest job is to service the Eldorado Mine at Great Bear Lake, whose northern shores are within the Arctic Circle. In the winter when the 1400-mile water route is closed, Brintnell's airplanes have the job of hauling silver and pitchblende radium concentrates 821 miles from the mine to the end of the railroad at Fort McMurray.

Last year Leigh added a Bellanca *Aircruiser* to his fleet of Fokker Super Universals and Fairchild 71-Cs, and it proved to be an ideal machine for the work. During one month, ten days of which were the worst sort of weather, 30,537 pounds of concentrates were flown from Eldorado to the railhead and, on the return trips, 35,000 pounds of supplies and passengers were moved North. The variable late-winter weather put the Bellanca thoroughly through its paces: the thermometer sometimes dropped to 35° below Zero, only to rocket in a short time to a point where the snow was melting—the weather up there is as changeable as a flock of New Deal crop-controllers honking along in full flight. Under all conditions the Bellanca got its two-ton load off without trouble, and could cruise at 145 mph with the Wright Cyclone at three-quarter throttle. Speed is especially desirable for air work in the far North during the winter months when the supply of daylight is almost as limited as Eugene Vidal's aviation experience.

This season Leigh added to his fleet the new *Norseman,* designed by my friend Bob Noorduyn, and built by his company in Montreal. The *Norseman* was designed especially for work in Canada over wild unsettled country where the nearest service station may be a thousand miles away. The engine is American, a Wright Cyclone.

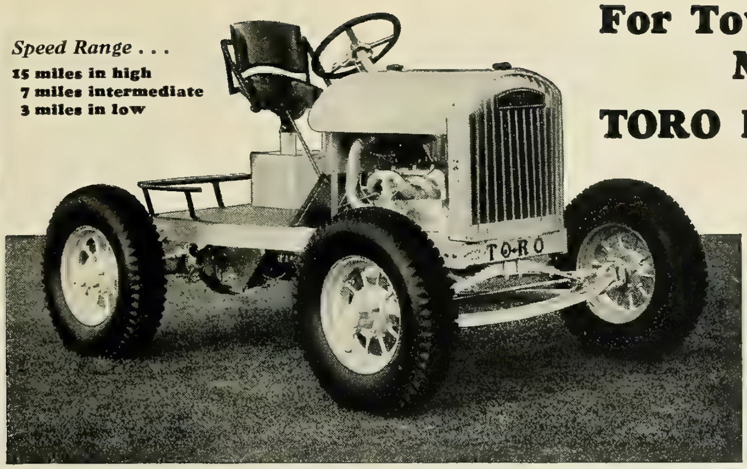
Leigh Brintnell has been flying since early 1917, when he joined the Royal Flying Corps. He received flight training at Deseronto, Ontario, turning out to be such an apt pupil that the Moguls made him an instructor. That was practically the same as being invalided out of the war, for he spent the rest of that period of international Hooliganism instructing the youth of the land how to fly and shoot without getting shot themselves—a good trick if they could do it. He instructed in Texas, at Camp Borden, and finally at the Central Flying School in England. He has outlived most of his pupils.

After the war to end war (until it is time for the next war to end war), Leigh sold real estate in Florida winters and flew summers for the provincial government of

(*Continued on page* 84)

A mere 35 degrees below zero means nothing to W. Leigh Brintnell

Speed Range . . .
15 miles in high
7 miles intermediate
3 miles in low



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The new TORO HUSKY Model C gives you everything you want in a sturdy, powerful, fast, heavy duty general purpose tractor for towing, shunting and airport maintenance operations such as mowing, dragging, hauling and snow-plowing. It is built to stand up under steady service summer and winter.

Toro means QUALITY! The established reputation of TORO tractors on golf courses and parks all over the world is your assurance of long faithful service. Convenient, complete service for TORO users is available through major distributing stations in larger centers.

The Husky is a short coupled tractor with a wheel base of only 71 inches and turning radius of 6¾ feet. Ford 40 H.P. motor with self-starter. Equipped with standard gear shift, three speeds. Handy controls. Comfortable deep saddle seat. Wheel equipment—pneumatic tires 7.50x16; singles or duals; steel wheels 30x7 front, 30x15 rear, with spikes.

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John C. Baur, Jr., of Santa Monica, Calif., says: I came to Curtiss-Wright where I completed the aircraft Metal Course and received an excellent recommendation to the Douglas Aircraft Company where I found employment the day after graduation. The School fulfilled my expectations and exceeded descriptive correspondence. The instructors I found of excellent character and technical ability.

CHOOSE
CURTISS-WRIGHT
SEE PAGE 8+9

The U. S. Army Corps' first official purchase of Grade A airplane fabric under the new specifications for weight and sizing was

B ★ A ★ 30

the fabric that had been conforming to these new standards since it was first produced, nearly three years ago.

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STATE AVIATION ASSOCIATIONS

Florida

Reorganization of the Florida Aviation Association, inactive for several years, and elimination of a number of differences of opinion about what steps the industry should take to aid future advancement in the state, were among the results of the annual aeronautical conference held at Orlando, July 9 and 10.

Move to re-create the association came during the first hour of the conference and followed closely the address of welcome of Harry Dickson, president of the Greater Orlando Chamber of Commerce and the response of Maj. A. B. McMullen, director of the aviation divisions of the Florida WPA and the state road department.

After R. V. Waters moved that the conference be dissolved as such, and be immediately reorganized as a meeting of a state association, G. Wayne Gray was elected president of the new association, and five vice-presidents were chosen, one from each of the congressional districts in the state, an arrangement which assures each section of representation on the board of directors.

Elected vice-presidents were: Thomas C. Imeson, Jacksonville; J. A. Waterman, Tampa; C. T. Hansen, Miami; Ralph U. Green, Daytona; and Francis W. Taylor, Pensacola. O. K. Holmes, Lake City, was chosen secretary-treasurer.

Virtually all agreed that some good had been brought about by aviation committees of various civic organizations, but there was unanimity in the belief that the association was the only answer to the problem of what to do to keep Florida in step with aviation developments. Improvement of Florida airports and aviation facilities generally was described by W. G. Stewart, executive officer of the WPA's division of aviation. This, he said, was divided into six major undertakings: 1. An official airways map, for distribution among the flying public, setting forth accurate information about Florida's aviation facilities. 2. Establishment of a safe, state-wide system of airways. 3. Assistance to counties and municipalities in enlarging and improving their airports to accommodate air traffic both from the standpoint of private flying and commercial airlines. 4. To provide an adequate system of air navigation aids for the entire state. 5. To provide hourly aviation weather information to airports and aircraft operators, through a state-wide radio network from those sections of the state not already served by existing agencies. These stations, either already in place, or under construction, will be situated at Jacksonville, Pensacola, Tallahassee, Orlando, Tampa and Fort Myers. 6. To encourage and promote more flying in the state, not only among the people of Florida, but also by the increased use of air mail and scheduled airline services, as well as by encouragement of private and military flying into Florida from other sections of the United States.

One of the most significant moves by the newly-formed association was the adoption of a resolution proposing that Congress and the War Department be requested to establish a National Guard or an active reserve air squadron in Florida.

Speaking on the second day of the meeting, Maj. McMullen urged continuation of an airport construction and maintenance program with state and federal governments jointly financing the projects. Harold Colee, president of the State Chamber of Commerce, urged the association to ask the next session of the legislature for more aviation funds for the development and improvement of airports and airways.

Michigan

Michigan Board of Aeronautics is pushing an airport completion program throughout the state. It is advising cities either with incompleted airports or sites upon which work still has to be done, to communicate with local and district WPA officials to impress them with the urgency of completing the development or at least putting it into usable condition.

A list of work desirable at all fields accompanies a special bulletin. Already 44 projects have work started, while an additional 40 were approved but not yet started. In all more than $2,200,000 is to be spent in the state for airport work.

Virginia

One of the most active groups in the country is the Virginia Aeronautic Association, organized May 11, 1936, and having to date almost 300 members.

Guided by its president, A. W. Card, the association already has succeeded in securing authorization for the state Dept of Highways to expend $25,000 for necessary airport construction and improvement; has had compulsory aircraft insurance laws discontinued; and has sponsored a successful series of air shows. It is now engaged in endeavoring to convince the governor of the advisibility of appointing as permanent director of aviation, one who has extensive aviation experience. The present appointee, R. E. Steele, does not meet these requirements, and the association has suggested that J. D. Driskill, a transport pilot with 5000 hours and 10 years of experience, be made a full-time aviation inspector.

Instrumental in having the governor call an aviation conference of representatives of the association, state officials, military pilots, and state directors of civic organizations, V.A.A. submitted a 5-year plan for advancement of aviation in the state.

The program contains items which can be useful in guiding other state associations in mapping out comprehensive plans for the advancement of aviation in their states, and is reported here.

1. To promote an adequate and safe state airport system with attendant facilities and increased air transportation service. *Recommended:* (a) continuation of A. H. Pettigrew as state airport authority of the highway department. (b) development of technical and supervisory staff in the department of highways. (c) complete survey of existing airports by the department of highways, jointly with the state planning board in cooperation with the state WPA, and the preparation of plans for definite construction or improvement. (d) authorization for expenditure of the entire $25,000 approved in the last session of the legislature. (e) authorization of the state airport authority to utilize such highway department grading equipment as may be necessary and to purchase necessary equipment not on hand. (f) authorization to continue the use of highway department engineers and survey parties, etc., without additional cost to the airport fund. (g) authorization to the state airport authority to cooperate with federal and state agencies for the proper completion of airport projects and the allotment of the necessary amount of state funds and highway equipment.

2. To promote safety in aerial transportation by well-planned airmarking and an adequate safe aviation inspection system. *Recommended:* The state corporation commission should be instructed to employ the necessary personnel and to enforce all state aviation laws which are in effect. (These laws were approved by the association at a hearing held previously).

3. To cooperate with state, federal and commercial agencies in promoting yearly air tours.

4. To stimulate interest through dissemination of current aeronautical news by radio broadcasts, public speaking, and directly by mail. *Recommended:* authorization for the expense for the state airport authority to cooperate with or independently publish and mail a bulletin at regular intervals to those interested in the progress of aviation within the confines of the state.

5. To assist sponsors in the passage of favorable state and federal aviation legislation and to coordinate state organization efforts thereto.

6. To assist in creating an adequate state Air Reserve and to acquire the necessary equipment. *Recommended:* authorization for the state airport authority in cooperation with state and federal agencies and others to promote, plan, and construct airports or landing fields on or near all state-owned colleges and to assist in securing the necessary equipment for establishing reserve units.

7. To provide a comprehensive home-study aviation ground school at cost. *Recommended:* authorization for the state airport authority to cooperate with various agencies in the promotion of model contests at airports and other activities attendant to this educational program.

8. To secure a Virginia trans-Atlantic air base with adequate service facilities and the extension therefrom of federal airways. *Recommended:* authorization for the state airport authority to cooperate with state and federal agencies in the promotion, planning, and construction of such an air base as soon as possible.

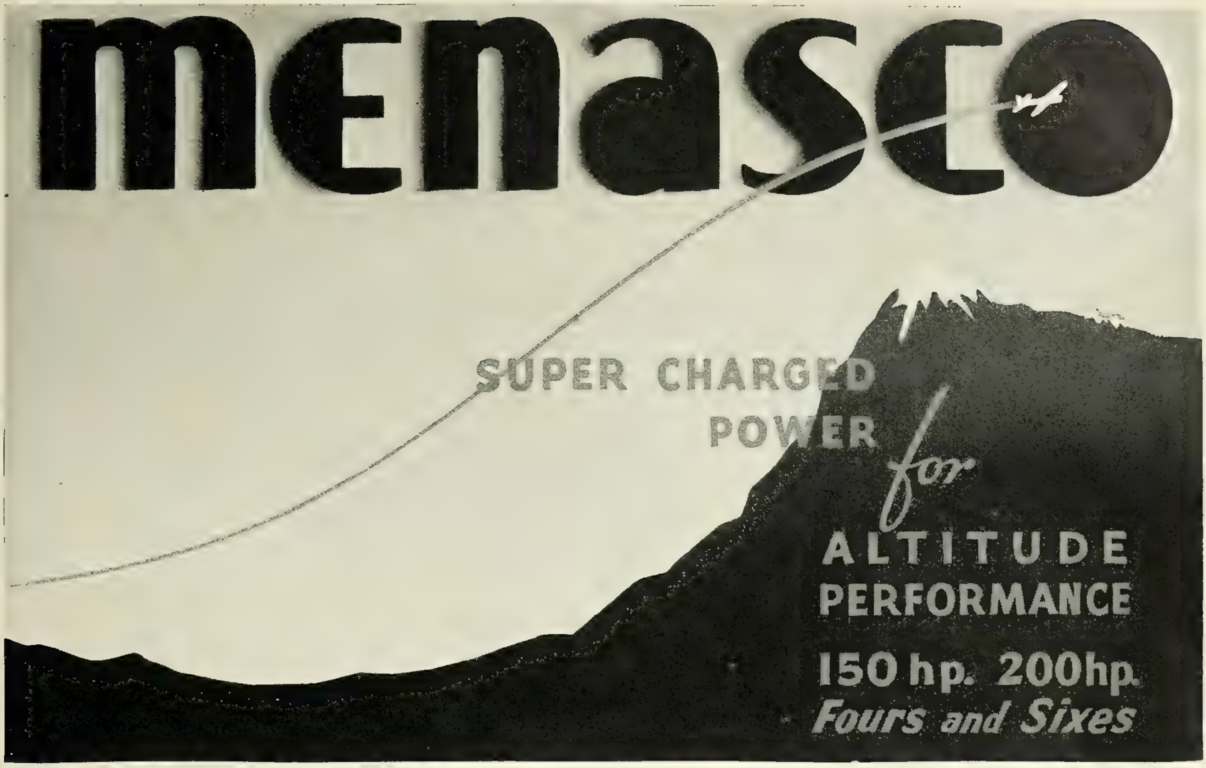
In summing up the above, it was requested that the governor grant a bi-annual conference to the officers and regional directors of the V.A.A. It was suggested that these conferences be held about the first of December and first of June of each year.

New Jersey

The New Jersey State Aviation Association will hold its third meeting August 6 at the Robert Treat Hotel, Newark, at 8 pm. It will be an informal gathering and cocktail party.

Several leaders in New Jersey aviation have indicated their intention of attending and addressing the members.

Present membership in N.J.S.A.A. totals 185.



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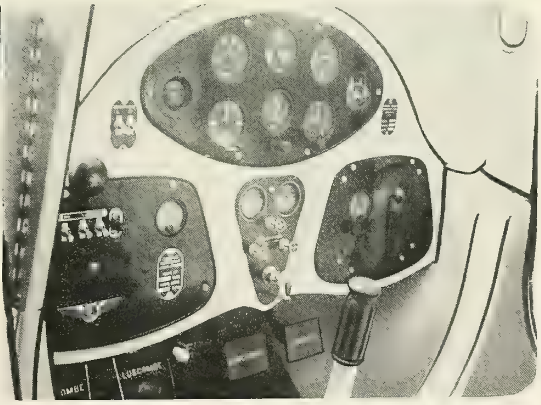

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DIGEST OF THE NEWS

AIRPORTS

Traffic Regulation

Establishment of permanent traffic control system on regular airways at principal airports was announced by Bureau of Air Commerce with Federal employees taking over responsibility at Newark, Chicago and Cleveland and replacing airline employees. Additional stations are to be established at Detroit, Washington, Pittsburgh, Los Angeles and San Francisco.

In operation from early morning to midnight or later, probabilities are that the system will be extended to a 24-hour basis.

Coordination and supervision of traffic will entail airline as well as private pilot operations, both being controlled into and from designated airports by traffic control officer.

First step in coordination was designation of 98 official air highways, each already operating and each 50 miles wide with limits extending 25 miles to either side of the center route between connecting airports. These routes will be used as working basis for traffic control regulations to become effective the 15th of this month.

2402 Airports

Increase in number of airports in United States is seen from Bureau of Air Commerce reports listing 2402 units on July 1, 1936, compared with 2343 on same date a year ago.

Seven states had 100 or more fields each, California leading with 192. Texas had 135, Pennsylvania 118, Michigan 114, Florida 122, Ohio 103 and New York 100.

Total includes 746 muncipal, 498 commercial airports, 291 Department of Commerce intermediate, 647 auxiliary, 62 Army, 26 Navy and 132 miscellaneous fields.

AERO DIGEST EXTENDS ITS WEST COAST FACILITIES

FRANK E. SAMUELS
West Coast Manager

WITH the addition of new personnel and equipment AERO DIGEST and THE SPORTSMAN PILOT expand the scope of their circulation, editorial and advertising facilities on the West Coast.

Activities of the three departments will be coordinated and supervised by Frank E. Samuels who, after twelve years as AERO DIGEST'S advertising representative, becomes West Coast Manager of both publications.

James C. Galloway, advertising representative for THE SPORTSMAN PILOT in the west, will handle advertising contacts for both publications under the new arrangement.

Members of the aviation industry on the coast are invited to make use of the more extensive facilities which are now available to them at 1129 Mohawk Street, Los Angeles (Fitzroy 6332).

New Airports

Youngstown and Warren (Ohio) chambers of commerce secured option on 1000 Trumbull County acres near Vienna for proposed community airports. Application is in for $300,000 WPA appropriation.

* * *

Department of Commerce leased 122 acres near Greeley, Colo. for an emergency field to replace old Greeley field on the Denver-Cheyenne route.

* * *

Anticipated aid from state and federal funds, bolstered by local capital is expected to push development of a closely-knit chain of airports in northern Michigan, with a view of opening up new vacation lands for sportsmen pilots.

Expansions

Southwest Aviation Service Co., Oklahoma City municipal airport is now equipped to handle complete engine and aircraft repair jobs as well as to provide student and charter flight work.

Expansion includes appointment of Norman Blake in charge of repair shop, George Hales in charge of radio department, according to Clyde R. Nuckols, operator and also in charge of radio instruction. Haskell Shaw will have charge of flight instruction and additional mechanics will be hired shortly to put company on a 24-hour service basis.

* * *

Largest seaplane fleet in summer operation is at Coonamessett Lake, Falmouth, Mass., where Cape Cod Seaplanes, Inc., flies Waco cabin, Fleetster, Fairchild 71, Rearwin Sportster and Stinson float-equipped craft. Company offers airline service between New Bedford and Nantucket via Wood's Hole and Martha's Vineyard in addition to activities at Falmouth airport.

(Continued on following page)

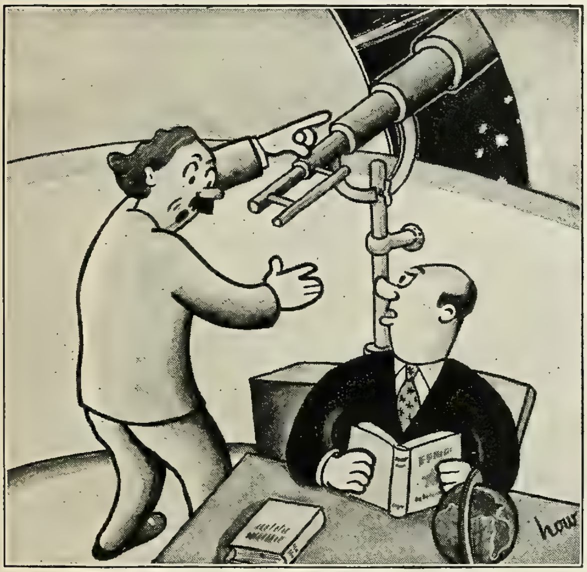
Twelve privately-owned Waco Cabin planes at Union Air Terminal, Burbank, where they are regularly hangared

Yes!

CURTISS-WRIGHT GRADUATES SECURE IMMEDIATE EMPLOYMENT

H. Ray Foottit, of Harlington, England, says: As you know I graduated from your Engineering Department in November 1934 and by the end of January 1935 I was employed at the Heston Aircraft Company, Ltd. here in England. I have just been engaged in the Fairey Aviation Company, Ltd. in a better position . I must say your training gave me the start I required.

CHOOSE **CURTISS-WRIGHT** SEE PAGE 8+9



"Eureka! I've just seen a new comet!"
"Nonsense, Professor. Just one of those planes with a new Glidair Finish job."

The Glidden Company offers to the aircraft industry a new line of Pigmented Nitrate Dopes. HIGHER LUSTRE—CLEANER COLORS—INCREASED FLEXIBILITY—EASIER POLISHING—EXCELLENT WEATHERING QUALITIES—*Write for free booklet.*

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EVERYWHERE ON EVERYTHING

Plants and Warehouses in all Principal Cities

Yes!

CURTISS-WRIGHT GRADUATES SECURE IMMEDIATE EMPLOYMENT

Robert D. Randolph, of Downey, Calif., says: Upon my graduation your placement service assisted me in obtaining a position with the Airplane Development Corporation in a department that I was especially adept in. As a result I am getting along fine. This individual interest in placing graduates in positions for which they are best qualified is a credit to the Institute.

CHOOSE **CURTISS-WRIGHT** SEE PAGE 8+9

A MASTERPIECE
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MODERN MANUFACTURE

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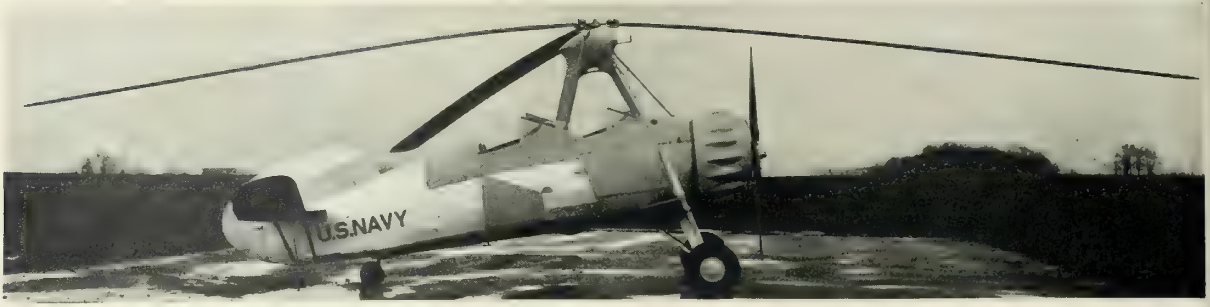


420 hp Wright-powered Pitcairn autogiro for the Navy

(Continued from preceding page)

Personnel Notes

New York State Airport Manager's Association officials re-elected Robert Aldrich president and secretary; Howard Shafer, treasurer.

* * *

Re-elected officers and directors of Pine Bluff (Arkansas) Airport Club and the Arkansas Airport Co. include L. Garrett, president of both groups; W. I. Pyne, first vice-president; F. Ingram, second vice-president; L. E. Leas, secretary-treasurer (Club); F. G. Smart, vice-president; K. Garrett, executive vice-president; G. H. Adams, secretary; H. J. Nichol, treasurer (Airport).

* * *

New Marine Air Terminal Advisor for Bureau of Air Commerce is Donald D. Cooke, who will operate from 79 Madison Ave., New York, N. Y.

* * *

Former Cram Field (Davenport, Ia.), shop supervisor Norman Blake, is now in charge of Southwest Aviation Service Co. shops, Oklahoma City Municipal Airport.

AIR SERVICES

Re-equipment

Navy Department awarded a contract to Consolidated Aircraft Corp., San Diego, Calif., for 50 twin-engined VPB type patrol boats costing $4,898,000. These are to be similar to the craft flown to two world airline distance records by Lieut. Comdr. Kneffler McGuiness, Oct. 14 last.

* * *

Award of a contract to the Curtiss Aeroplane & Motor Corp. for a quantity of Cyclone-powered twin-engined Y1A-8 attack planes for the Army Air Corps was announced by the War Department. The mid-wing all-metal planes will cost $1,259,235.

* * *

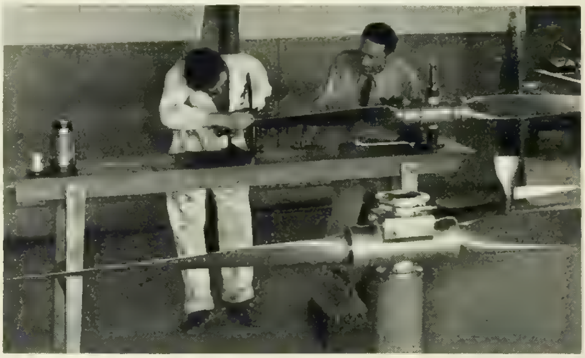
Bolling Field received a new BT-8 from Seversky Aircraft Corp., which, after routine test flights, was assigned to Maj. Gen. Westover, Chief of the Air Corps, and attached to 14th Bombardment Squadron, GHQ Air Force. General Westover's O-38F was reassigned to 21st Observation Squadron, GHQ Air Force, for general flying.

* * *

34th Attack Squadron, March Field, Calif., has been equipped with six Northrop A-17's, the 73rd with three and the 17th Group Headquarters with two.

Army Bases

The $5,000,000 Hamilton Field, 7th Bombardment group headquarters, near San Rafael, California, has been completed. Situated midway between the Canadian and the Mexican borders, the post covers 928 acres improved by three double hangars and one operations hangar costing $937,580. In addition are a quartermaster's warehouse, photographic laboratory, guard house, ordnance magazines and warehouses and garages.



Student and instructor in the enlarged propeller department at Parks Air College

Field buildings include 34 homes for married officers, housing quarters for bachelor officers, 22 double houses for non-commissioned officers and 3 enlisted men's barracks each accommodating 200 residents.

* * *

Board of three officials, named by Secretary of War Dern to pick a site for an Alaskan Army air base, left July 15 to study climate, soil foundation and topography for a site in the vicinity of Fairbanks. Board members are Lieut. Col. Wilmot A. Danielson, Quartermaster Corps; Major Otto G. Trunk, Air Corps and Major Albro L. Parsons, Medical Corps.

General Malin Craig, Chief of Staff, said the survey was pursuant to provisions of the Wilcox act, authorizing a network of air bases situated in seven geographical areas for protection of the coast line, interior and continental possessions.

Mackay Trophy

Twenty-third annual award of Mackay Trophy, presented to Air Corps officers for each year's most outstanding flight achievement, was awarded to Maj. Albert W. Stevens and Capt. Orvil A. Anderson for their stratosphere flight during which they reached an altitude of 72,395 ft. Presentation was made by Maj. Gen. Oscar Westover, Air Corps Chief.

SCHOOLS

New Courses

Special high school teachers summer training course has again opened at Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif. Willard Staples, who has been in charge of this course since its inception several years ago, is again director.

* * *

Central Airlines has arranged a practical course of two weeks for members of the graduating class in the School of Aeronautics, University of Pittsburgh, who desire to get first hand knowledge of air transportation. Detroit shops of the airline will be inspected by the students. While in Cleveland they will study meteorology and traffic.

* * *

Boeing School of Aeronautics, Oakland, Calif., is starting on August 4 a special sheet metal course. Requiring three months of instruction, the course is spread over 8 hours a day, 5 days a week, for 480 hours.

Equipment

A Stinson *Reliant* powered by a 260 hp Lycoming engine with a Hamilton Standard propeller, and equipped with flaps, has been added to the Boeing School squadron of training planes. There are nine different types of planes in the school's training fleet.

* * *

Now included in the equipment of Spartan School of Aeronautics, Tulsa, Oklahoma, is the all-metal low-wing Spartan Executive model four-place cabin, for use of members of the Dawn Patrol. Transport students fly this plane with its hydraulic operated flaps and retractable landing gear, and Spartan students work as apprentice mechanics in the Spartan factory in the construction of the Executive model.

* * *

Equipment in newly enlarged propeller department of Parks Air College Master Mechanics' School was manufactured in the school in the course of instruction, excepting the balancing stand and the flexible shaft polishing machine. Wood patterns and molds for the cast iron pedestals, pitch tables and also straightening fixture which is located in the background, were made by advanced mechanics students. They also did the final machining of the various parts and assisted in their placement.

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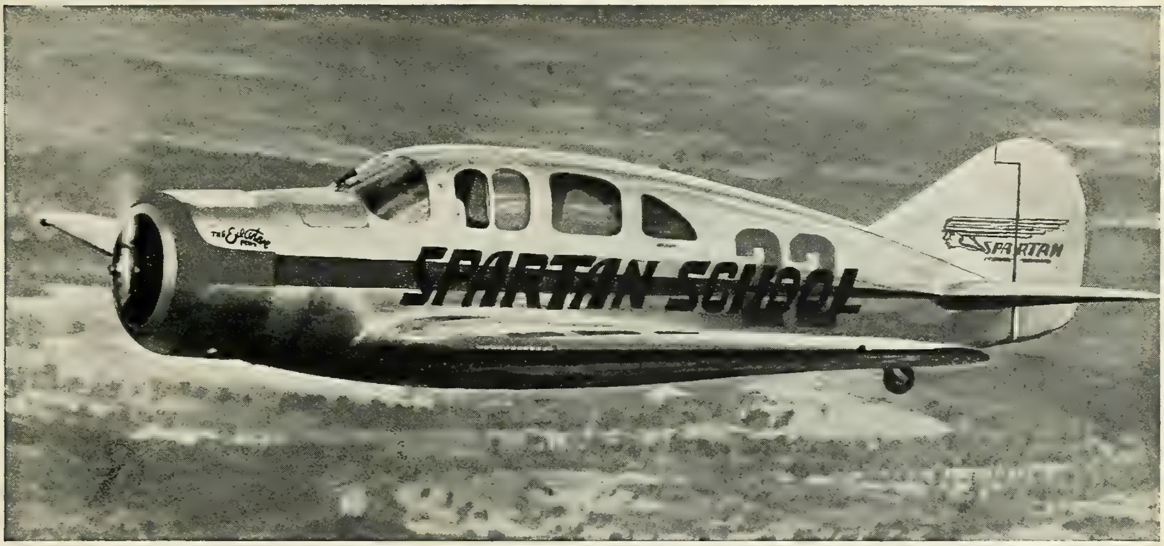

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AIRLINES

New Services

Mail and passenger service from Kansas City through Omaha and Sioux City to the Twin Cities was inaugurated by newly-reorganized Hanford Airlines, Inc., in which Thomas Fortune Ryan III holds financial control. New Lockheed *Electras* placed in service cut 2 hours, 30 minutes off old schedules for the run. Company is considering extension of line to Tulsa.

Officers of new company are A. S. Hanford, pres.; Ryan, exec. vice-pres.; J. W. Miller, vice-pres. and gen. mgr.; J. C. Collins, sec.-treas.

* * *

Illinois Commerce Commission granted permission to Chicago and Southern Airlines, to operate passenger service between Chicago, Peoria and Springfield, Ill. and St. Louis, Mo. Line is to be extended to include Bloomington, Ill., when its airport is available for use. Airline operates one plane daily each way.

96,368 Passengers

All-time records were broken by 20 airlines in the United States when they carried 96,368 passengers during May, and flew 40,097,155 passenger miles. Highest passenger total for any previous month was 89,581 and former peak for passenger miles flown was 35,732,204, both set in August, 1935.

Companies operating during May reported 483,798 pounds of express carried and 255,623,294 express miles flown. Total miles flown were 5,511,070. Another record established in May was for percentage used of passenger seats available, 69% of available seats being occupied, compared with highest previous percentage of 62 in March, 1936.

* * *

Increase of 3% in air passenger traffic during June over May on the Washington-Detroit Airway is reported by D. Walter Swan, vice-pres. in charge of traffic for Central Airlines. Passengers carried totaled 2472.

* * *

Pennsylvania Airlines transported 6196 passengers over the Washington - Detroit - Milwaukee route in June, setting a new high record for business handled during a thirty-day period. Most marked increase was shown on the Detroit-Grand Rapids-Milwaukee division, where business totalled 1232 passengers, 35% over May and 189% over June of last year.

* * *

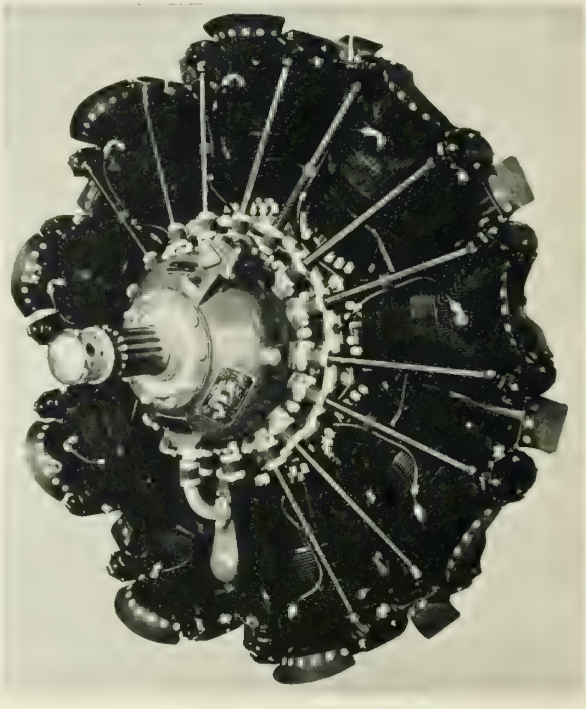
Increase of 56.3% in express, 39% in mail and 28.9% in revenue passengers transported over its system was announced by Transcontinental & Western Air, Inc., for the first half of 1936 over the corresponding period of last year. Increase in passenger miles flown was 14.1%, actual rise being 4,111,330 passenger miles. Comparing June this year with June last year, TWA carried 1,509 more passengers; 15,536 more pounds of express; and 54,613 more pounds of mail.

* * *

Greatest number of passengers ever carried during a single day in the history of the company was reported by Northwest Airlines on July 3, when the total number carried was 31% greater than previous records.

* * *

Summary of traffic during the first six months of 1936 on the New York-Chicago-Pacific Coast and Seattle-San Diego routes of United Air Lines shows a 15% increase in passenger business and a 50% gain in express poundage, as well as a 11.5% rise in mail. During the period United carried 91,830 revenue passengers; 1,040,482 pounds of express and 2,661,144 pounds of mail, while flying 7,833,635 miles.



New 1000 hp Wright Cyclone R-1820-G, several hundred of which will be used for Douglas and Boeing bombers

Personnel Changes

Resignation of C. W. France as operations manager of Eastern Air Lines to accept the vice-presidency and general managership of Curtiss-Wright Airplane Co., brought promotions to S. L. Shannon as operations manager, and George E. Gardner as assistant operations manager.

PRIVATE FLYING

Contest Results

Combination air and balloon race event at Denver last month drew 75,000 persons who saw Rudy Kling set a new 100-kilometer flight record when he averaged 228.0725 mph in a Keith-Ryder Special. Col. Roscoe Turner pioneered a speed course around Pike's Peak and Cheyenne Mountain flying 146.066 miles at an average speed of 163.792 mph in a P & W powered Boeing 247 transport.

Art Chester won both the 375 and 550 cu. in. events; Lee Miles took the 800 cu. in. ATC, and Bill Ong was first in the unlimited ATC race. Chester flew one of his Specials, Miles a Cessna and Ong a Beechcraft. Managing Director Jim Ewing paid out approximately $8500 in prize money.

Five balloons started national elimination flights, the winner being Frank A. Trotter who piloted the Goodyear entry approximately 385 miles. Second place went to the Great Lakes Exposition balloon and third and fourth to the U. S. Navy bag. Winners of first three places qualified for the Gordon Bennett international race to be held the 30th of this month at Warsaw.

* * *

United States gliding and soaring achievements attained new proportions at the 7th annual contest held at Elmira, N. Y., when 81 contestants with 23 soaring craft surpassed all event marks by soaring 354 hours and covering 1283 miles. Highest honor in soaring, silver "C" award, was won by five pilots. Three achieved the ranking in previous six years of competition in this country.

Outstanding performances marked the meet. Chester Decker made flights of 75 miles and 146.6 to clinch 1936 championship honors; Emerson Mehlhose attained a height of 6516 ft.; Henry Wightman set a world record for utilities by gliding 135 miles and John Batterson and Albert Slatter took a two-place *Buxton* to 5967 ft. Endurance achieved included 8 hours 48 minutes by Slatter and Jay Buxton (world record), while Richard duPont established a new category by flying 37 miles in a round-trip flight.

Noteworthy was use of a new launching device employing the winch method developed by Gustave Scheurer to supplant auto towing. So successful was the meet that Soaring Society of America directors decided that the 1937 event be international in character. DuPont was appointed chairman.

Safety Record

Private owners of Stinson *Reliant* planes also Air Cab Operators using these planes have flown approximately 7,000,000 miles in the first six months of 1936 without fatality to pilot or passengers, according to B. D. DeWeese, president of Stinson Aircraft Corp. This record is a continuation of the safety record of flyers of Stinson *Reliants* set in 1935, when Stinson inaugurated the "Fly Safely Campaign."

Elections

Aviation Country Club of Pal-Waukee Airport, Chicago, Ill., at its annual election of officers, chose Lloyd Laflin pres. and treas. to succeed Albert A. Sprague. Chester Faust was elected pres. of the board and vice-pres. of the club, Clifford Condit manager of the airport, and Bill Turgeon flight instructor.

THE INDUSTRY

Production

Production program of 100 Ranger 6-390-D aircraft engines has been launched by Ranger Engineering Corp., Farmingdale, L. I., the first large-scale production undertaken by the company, the aircraft engine manufacturing division of Fairchild Aviation Corp.

Ranger 6-390-D is an advanced model of the 6-390-B brought out last year as a six-cylinder, inverted, in-line, air-cooled engine

(Continued on following page)

Pan American Officials Choose REARWIN *"Sportsters"*!

REARWIN "Sportster" Models 7000, 8500 & 9000
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● After careful consideration two high officials of Pan American Airways have purchased Rearwin "Sportsters" for their personal use. The same features of *appearance — construction — performance*—which appealed to these sportsman pilots are responsible for the large number of Rearwin sales to schools and private owners throughout the world.

APPEARANCE—Clean, graceful lines. Beautifully and durably finished. Cabin attractively lined and tastefully upholstered.

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(Deluxe ball bearing controls concealed under floor boards are available at slight additional cost.)

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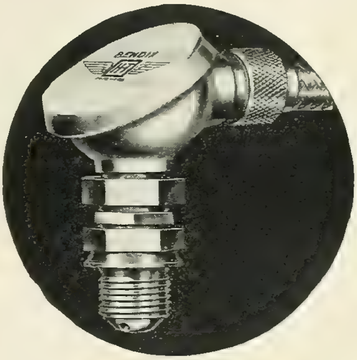


To the list of notable flights in which Bendix H-T Aircraft Spark Plugs have participated, Mr. Harold Farquhar adds another inspiring entry. His recent 23,000 mile flight from Mexico City to London was completed with the identical eighteen Spark Plugs installed at Wichita before the start. Such performance is typical of the high degree of reliability of this widely used ignition equipment.

SCINTILLA

MAGNETO COMPANY, INC.

(Subsidiary of Bendix Aviation Corporation)

SIDNEY, NEW YORK

(*Continued from preceding page*)

delivering 145 hp at 2250 rpm. Model D incorporates refinements in design and construction, such as 25% more fin area, increased hp at lower rpm and improved manifolding to lower fuel consumption.

* * *

Taylor Aircraft schedule production at the rate of three planes a day for the balance of 1936, increases former schedules of more than two Cubs a day.

Business Reports

Consolidated net loss of American Airlines, Inc., and subsidiary companies for 1935 amounted to $748,370 after $1,118,093 reserve for depreciation and obsolescence. This compares with a net loss of $2,313,678 after depreciation of $1,034,317 for this company and its predecessor for 1934.

During 1935, 176,005 paid passengers were transported, showing an increase of 103.8% over 1934, although increase for entire industry for same period was approximately 67%. Mail transported increased 47.6% and express revenue showed a 47.7% increase over 1934. Operating costs per mile for the year 1935 were substantially lower than for 1934.

* * *

To provide for contemplated expansion program, directors of Bell Aircraft Corp., Buffalo, N. Y., decided upon a refinancing plan, subject to approval of stockholders and registration of new securities with Security and Exchange Commission. Contemplated plan will bring an additional $500,000 working capital over and above present paid-in capital of $400,000, and will permit corporation to handle more business, with the immediate leasing of additional space.

* * *

Robert Porter, president of Kinner Airplane & Motor Corp., Ltd., reported orders on hand at present amount to $120,376, as compared with $71,000 at the same time last year. Current assets are $215,856, as compared with current liabilities of $112,419.

* * *

Net income of $64,748 for 1935 was reported by Curtiss Aeroplane & Motor Co., Inc., Buffalo, subsidiary of Curtiss-Wright Corp. This compares with a deficit of $242,094 in 1934, although net sales dipped from $2,773,655 in 1934 to $1,941,789. Current assets advanced from $4,013,144 to $5,357,672 and cash increased from $221,146 to $279,089.

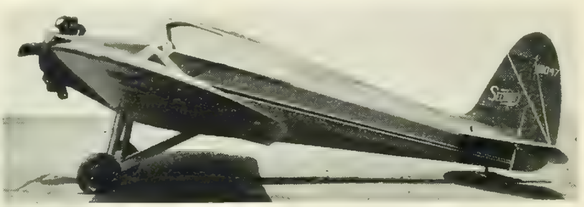
* * *

Sales of approximately 1300 Cyclone and Whirlwind aircraft engines during the first six months of 1936 were announced by Myron B. Gordon, vice-pres. and gen. mgr. of Wright Aeronautical Corp. Over 1000 Cyclones of various power ratings are included in the total engines sold, including several hundred with 1000 hp at take-off to the U. S. Army Air Corps for new Boeing and Douglas bombers.

* * *

200,000 shares of common stock of Seversky Aircraft Corp., part of 840,000 shares registered with the Securities and Exchange Commission, was offered at $3.75 a share to fill the company's new capital requirements. Largest stockholders are Paul Moore, a director; Maj. Alexander P. de-Seversky, president, director and chief executive officer, and Seversky Aero Corp. holding a total of 240,586 shares. Balance of outstanding shares is held by fourteen stockholders.

Security-powered Security sportplane produced by Bert Kinner



* * *

Douglas Aircraft Corp. offered 93,480 shares of capital stock to present holders of record at the close of business July 13, at a ratio of one share for each five held, at $45 a share. Rights expire August 3 and any stock not taken will be offered to the public.

Technical Meeting

First technical meeting on production problems held by the aircraft industry takes place Oct. 15-17 in Los Angeles, under sponsorship of SAE.

Carleton E. Stryker, chief engineer, Curtiss-Wright Technical Institute of Aeronautics, Glendale, Calif., has been appointed general chairman of the meeting, plans for which have been made under the auspices of the Society, of which Mac Short, Stearman Aircraft Co., is vice-president representing aircraft interests, and Opie Chenoweth, U. S. Army Air Corps, is vice-president representing aircraft engine activities.

(*Continued on following page*)

Digest of Recent Events

Gliders Set New Marks at Elmira

World and American records were surpassed during the seventh annual soaring contest at Elmira, N. Y. American records were: altitude in 2-place glider by Albert Slatter and John D. Batterson, 5967 ft.; distance by Chester Decker, 146.6 miles. World records were: distance and return, Richard duPont, 37 miles. Champion of the meet was Decker with 295 points. Next was duPont, 288 points; Slatter, 218; Henry Wightman, 210; Emerson Mehlhouse, 171. JUNE 24-JULY 5

Distance Mark Set By Army Amphibion

Flying 1425 miles from San Juan, Puerto Rico to Langley Field, Va., in 11 hours 9 minutes, Maj. Gens. F. M. Andrews and Frank R. McCoy and a crew of six set a world non-stop distance record for amphibions of the Douglas OA-5 type. The previous record was from Puerto Rico to Miami, 600 miles less than the new mark. JUNE 29

New Douglas Lowers Boston-N. Y. Time

Existing city-to-city records between Newark airport and Boston were broken when an American Airlines' Douglas DC-3 flew the 218 miles in 56 minutes. The plane was powered by two Series G Cyclone engines which develop 1000 hp for take-off, and 850 hp at altitudes. Ray Wonsey and S. J. Wardwell were at the controls of the Douglas. JULY 1

Class C Airplane Speed Mark Made

Rudy A. Kling set a world record for Class C airplanes (544 cu. in displacement) at the Denver Mile High Air Races when he flew his Menasco-powered Keith-Ryder over a 100-kilometer course at an average speed of 228.072 mph. The former record, 222.863 mph, was held by Art Chester. Time for Kling's 62.137-mile flight was 16 minutes 22 seconds. JULY 4

British Distance Mark In Glider Set By Wills

Philip A. Wills established a new British long-distance record for sailplanes by flying from Dunstable to Pakefield, 102 miles away in 4 hours 30 minutes. Wills flew a British-built *Hjordis*. The old record was 95 miles set by Eric Collins. JULY 5

"Hindenburg" Again Cuts Trans-ocean Travel Time

Fourth flight from Frankfort-on-the-Main to Lakehurst, N. J. by LZ-129 *Hindenburg* was completed in 50 hours 33 minutes for a new record westward crossing. Twenty-one passengers were aboard, with Capt. Ernst Lehmann in command. Eastward crossing also bettered former marks, the ship landing in Germany in 45 hours 43 minutes, compared with 48 hours 7 minutes, the former best time for the eastward trip. JULY 6

Eight Seaplane Records Established By Italian Plane

International records in eight categories were claimed by Capt. Mario Stoppani when he flew a tri-motored seaplane during acceptance tests at Orbetello, Italy. Records set, all formerly held by U. S. pilots, were speed for 2000 km. in four classifications with speed of 190.66 mph, and for 1000 km. in four classifications with speed of 194.48 mph. Four classifications were flights with loads of 500, 1000 and 2000 kg.; and without payload. JULY 8

Louise Thaden Breaks Speed Record for 100-km.

New women's speed record of 109.58 mph was set by Louise Thaden over a 100-km. course when she flew a 90 hp Monocoupe over a measured course at Endless Caverns, Va. The course was covered in 34 min. JULY 12

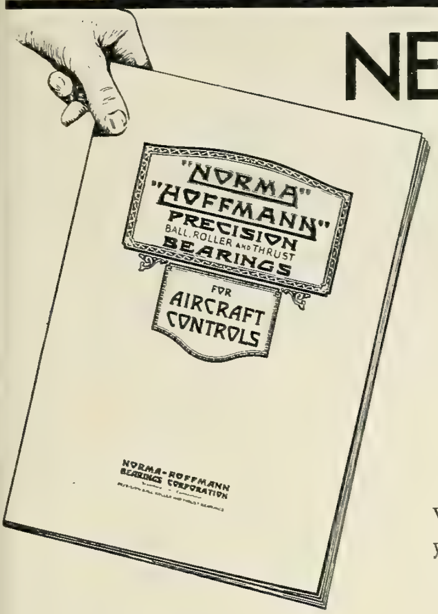
Junior Cross-Country Flight Time Lowered

Peter Dana landed with two new records at North Beach Airport, New York, N. Y. in a 125 hp Menasco-powered Ryan S-T from San Diego. He broke the eastward junior transcontinental record, and set a speed record for the distance for planes under 1200 lbs. His flying time was 22 hours 5 minutes, compared with Bob Buck's record of 23 hours 47 minutes. Dana's elapsed time was 23 hours 37 minutes. JULY 18

Soviet Flier Reaches Record Altitude

An altitude of 36,089 ft. (11,000 meters) was attained by Vladimir Kokinaki who flew a small two-place plane of Soviet construction with a payload of 1102.311 lbs. (500 kg.) in a 63-minute ascent over Moscow. The flight establishes a new record for planes of this type. JULY 18

NEW!



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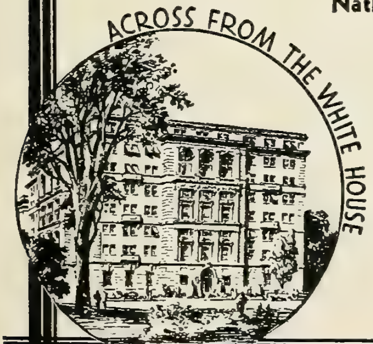
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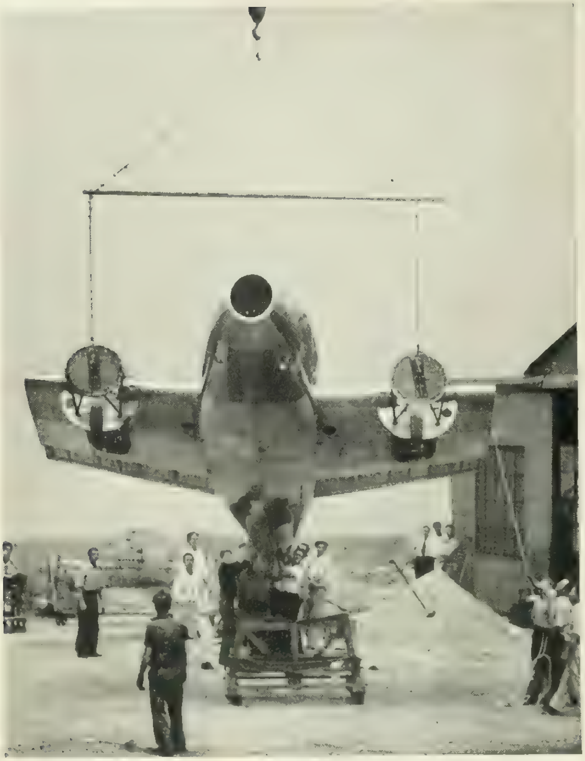


Hoisting a Lockheed 12 fuselage and center section preparatory to inverting it for stress and load factor wing tests

(Continued from preceding page)

15,204 Pilots

There were 15,204 pilots and 7,403 aircraft holding active Department of Commerce licenses on July 1, 1936, compared with 14,806 pilots and 7,205 aircraft on July 1, 1935.

Total number of aircraft licensed and unlicensed on record July 1, 1936, was 9,167, while this number on the corresponding day of last year was 8,887. Unlicensed aircraft (bearing identification numbers only) totaled 1,764 on the first day of July, 1936.

Among the 15,204 persons holding pilots' licenses as of July 1, were 7,162 transport, 863 limited commercial, 6,417 private, 761 amateur and 1 industrial pilot. Licensed pilots included 418 women classified as follows: transport, 70; limited commercial, 28; private 260; and amateur, 60.

Personnel Notes

Waco's chief engineer A. Francis Arcier has received a fellowship in the Royal Aeronautical Society.

* * *

James P. Eames has been appointed chief aviation instructor at the Federal Adult Educational Administration, San Francisco.

* * *

Harold Mansfield has taken over Richard Rummell's duties in the publicity and advertising department of Boeing Airplane Co. Rummell has joined United Air Lines in Chicago.

* * *

Bendix Products Corp. has elevated Herbert L. Sharlock to the position of vice-president and director of publicity.

* * *

With the resignation of Capt. Homer Berry, president of Crusader Oil Corp., *Blue Shield* oil activities are now managed by A. G. Richardson and J. R. Less.

* * *

Col. V . E. Clark has been chosen to direct engineering for Fairchild Aviation Corp., in the capacity of vice-president.

New Planes

Rouffaer Aircraft Co., Oakland Airport, is constructing a two-place dual control cabin plane which will be powered by a new 80 hp engine and designed to have a maximum speed of 133 mph, cruising speed of 112 miles, landing speed of 44 mph, and 450-mile range. This plane will weigh, empty 518 lbs., fully loaded, 1050 lbs. Fuselage and tail surfaces will be of steel tubing, fabric covered, with full cantilever wings, fabric covered. Length, 21 ft., span 31 ft., height 7 ft. 6 in., wing area 120 sq. ft. Completion is set for early September.

* * *

Waldo Waterman has developed a new aircraft with detachable wings, convertible into a vehicle which will propel itself along the highway. A conventional Studebaker automobile engine is used for power, and which, by means of a clutch, can be engaged either with the propeller or with the road drive shaft. A new company has organized to manufacture this plane under the name of Waterman Arrowplane Corp. Layout work is under way at present for production in Santa Monica, Calif.

ATCs Issued

Beech Aircraft Corp.; CR17R, 4- or 5-place cabin biplane; 420 hp Wright Whirlwind R975E-3 (ATC 604).

Fairchild Aircraft Corp.; XA-942-B, 8-place cabin amphibion monoplane; 760 hp Wright Cyclone SGR-1820F-52 (ATC 605).

Porterfield Aircraft Corp.; 35V; 2-place cabin monoplane; 65 hp Velie M-5 (ATC 606).

Douglas Aircraft Corp.; DST, 33-place cabin monoplane 2 850 hp Wright Cyclone GR1820G-5 (ATC 607).

Stinson Aircraft Corp.; SR-8B, 5-place cabin monoplane; 245 hp Lycoming R-680-6 (ATC 608).

Lockheed 12 on Tour

Lockheed 12, a 230 mph twin-engined commercial airplane, left the factory in Los Angeles last month on its first major flight. The 12 is an 8-place, twin-engine transport closely resembling the *Electra*. It is powered by two 450 hp P & W Wasp Jr. SB engines which give it a cruising speed of 208 mph at 9,600 ft. at 60% power. Cruising range is 880 miles.

Factory Removals

Porterfield Aircraft Corp. to 25th & Charlotte Sts., Kansas City, Mo.

* * *

Engle Aircraft Specialties from Glendale to Escondido, Calif., into first of two buildings to be built to accommodate increased streamlining and metal working business.

* * *

Taylorcraft Aviation Co. to former Argo Airplane Co. factory in Alliance, Ohio, from Pittsburgh, Pa. Modern factory measures 60′ x 300′ together with smaller units.

Expansion

Factory space at Bradford, Pa., for *New Cub* production by Taylor Aircraft Corp. has been tripled in past 18 months and more machinery and equipment added to meet demand for aircraft ordered.

New Factories

A sixteen-year lease has been taken by Stearman-Hammond Aircraft Corp., on a 15-acre tract adjoining Mills Field, San Francisco, for construction of a modern factory building. The company also has an option to purchase the site and also specified adjoining acreage.

* * *

New Cub will be manufactured in Canada by Cub Aircraft, Ltd. Factory will be erected in Hamilton, Ont., by R. L. Gibson, president of new company.

New Companies

Ariel Aircraft Co., Inc., Brook Park, Cleveland, Ohio. P. H. Mitchell, E. Cunningham, G. Knott incorporators.

Midwest Aviation Corp., Columbus, Ohio. D. N. and V. C. Richeson, C. K. Bradley incorporators.

Parkersburg Flying Service & Aviation School. Parkerburg, W. Va. Fixed base operation; Waco and Taylor agency and flying school. J. Sadowsky and J. W. Stewart operators.

Aircraft Forwarding & Repair, Inc., Buffalo, N. Y. D. Coe, V. Hughey, E. M. Bourke incorporators.

Alaska Clipper Express, Inc., Seattle, Wash. Seattle-Alaska airline with Sikorsky amphibians. J. S. Caldbrick, E. M. Laird, J. K. Baird, D. D. Mote incorporators.

Aero Activities, Inc., Municipal Airport, Los Angeles, Calif., authorized repair agency; crop dusting activities with Stearman C-3-B's; aircraft and engine sales; aerial advertising. K. C. Hawkins, president.

Coming Events

International gliding demonstration in conjunction with Olympic Games. Templehoff Airport and on the Wasserkuppe. August 4

●

Dominion finals, John C. Webster Memorial Competition, Kingston, Canada. August 23-24

●

1936 National Air Races, Los Angeles, Calif. Sept. 4-7

●

Deutsche de la Meurthe Cup Race, auspices Aero Club of France, Etampes Montdesir Airport. Sept. 13

●

Air Service Veterans re-union and banquet, Hotel Carter, Cleveland, Ohio, during American Legion Convention. Sept. 21-24

●

National Aircraft Production Meeting, SAE, Los Angeles, Calif. Oct. 15-17

●

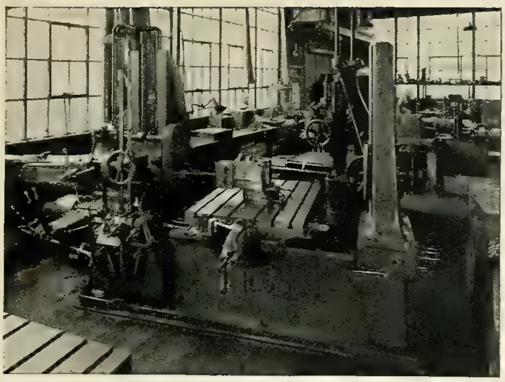
Paris-Saigon round-trip speed race, sponsored by Aero Club of France. October 25

●

International Aviation Show, Grand Palais, Paris, France. November 13-29

●

National Aircraft Show, auspices Aviator's Post 743, American Legion, Grand Central Palace, New York, N. Y. Jan. 28-Feb. 6, 1937



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FOREIGN NEWS IN BRIEF

Australasia

Civil Aviation Board has been set up in Australia to administer Civil Aviation Branch of the Department of Defence. Personnel consists of a chairman and three others with designations of Controller of Operations, Controller of Organizations, and Finance Member. Duties of the Chairman embrace matters pertaining to civil aviation policy, administration of Commonwealth civil aviation legislation, international conventions relating to air navigation, and development of new transport services.

Although radio direction finder apparatus was installed at the Essendon (Melbourne) airport two years ago, Australia's first radio beacon station aircraft along a radio beam was officially inaugurated at the Mascot (Sydney) airport. The new equipment, manufactured in Australia, is designed to send beams in four directions, with a range of approximately 200 miles.

Eurasia Aviation Corp., extended its semi-weekly Shanghai-Szechuan service to Yunnanfu. Planes operate from Shanghai to Chengtu via Nanking and Sian in one day, proceed to Yunnanfu the next morning, return to Chengtu the same day, and return to Shanghai the following day.

Karachi-Madras mail service operated by Tata & Sons showed considerable gain in 1935. Miles flown were 287,040, nearly double those of the previous year, while the number of passenger-miles increased from 8,245 to 25,925. A total of 67,633 pounds of mail were carried during the year as against 41,478 in 1934.

Report on civil operations in Australia and New Guinea by the Controller General of Civil Aviation shows 5,641,281 miles flown in 65,151 hours. Passengers carried were 62,910. Weight of express was 8,463 tons excluding almost 70 tons of mail.

Latest figures show 243 commercial pilots in Australia, 263 registered aircraft and 368 licensed airports.

Airlines of Australia, Ltd., duplicated their 2000-mile Sydney-Brisbane service which now operates twice daily in each direction. At present it is flown by two Stinson Airliners and a Monospar.

First Australian built *Gannet*—a high-wing monoplane carrying seven passengers, and powered with two Menasco engines—was to go into service between Sydney and New Guinea last month.

Previous *Gannets* were equipped with Gypsy VI engines.

W.A.S.P. Airlines, Ltd., operating Sydney-Broken Hill, Sydney-Griffith and Sydney-Coonamble routes increased capitalization to £100,000.

Guinea Airways, Ltd., have paid a 20 percent dividend for 1935 and quarterly interim at same rate for first two quarters of 1936. In addition to two Stinson Reliants now in service, a Taifun and two Lockheeds (one Electra and one 12B) are on order.

Belgium

Fleet of SABENA, Belgian commercial air transport company, covered during April, 1936, a distance of 68,368 miles, and registered more than 310,500 passenger miles. More than 12 tons of express and 3,021 pounds of mail were transported. For the first four months of 1936, company's traffic returns indicate 714,150 passenger miles, 25,606 ton-miles of express and 3,117 ton-miles of mail.

Canada

Canadian amateur pilots seeking the coveted John Webster Trophy, awarded annually for skillful airmanship, gather at Kingston, Ontario, on August 22 and 23, where the fifth annual competition will be held under the auspices of the Canadian Flying Club Association, in co-operation with the Kingston Flying Club. Last year the trophy was won by G. R. McGregor, president of the club.

Prior to the finals, elimination events will be held at several points, the largest entry list being at Regina for the Prairie Provinces, under the direction of the Regina Flying Club.

Mail service was inaugurated late last March between Haileybury and Mud Lake, in northern Ontario. Service is twice weekly in each direction.

Figures released by the Civil Aviation Branch, Department of National Defence, for the first quarter of 1936 show mail carried on 28 routes amounted to 348,822 lbs.; 85 more trips were made than were scheduled, and the 1,977 trips totaled 250,000 miles.

Report shows that light airplane clubs flew 77 planes 1,208 hours, while among the 2,309 members, 37 obtained private and 3 commercial pilot certificates; 572 students were under instruction.

During the period, 332 commercial and 49 private planes were in use. There were 509 private pilots, 419 commercial, 491 air engineers and 99 air harbors. On the trans-Canada airway, intermediate field work progressed by the end of March to allow landings on 32 fields. Work was going on at 17 others, and 18 still required development.

Two-way radios are being installed in Mackenzie Air Service planes operating in the far north. Seven ground stations, two operated by the company and five by the Royal Canadian Corps of Signals, will help keep radio-equipped craft in constant communication with airports along regular northern routes into Lake Athabaska, Great Slave Lake and Great Bear Lake Mineral fields.

Civil Aviation Branch is to be transferred from the Department of National Defence to the new Ministry of Transport. The new department will include railways, marine, canals and radio, thus bringing all transportation and communication systems under one department head instead of three as at present.

Sikorsky S-43 amphibion now operating between Dakar and Pointe Noire for Chargeurs Reunis

Canada's aviation budget this year exceeds any recent year, with the result that the R.C.A.F. is being rebuilt. Parliament appropriated about $7,000,000 in addition to large sums for hangars, airports and emergency landing fields. Air force personnel is expected to increase this year by 40 percent.

France

The new airport at LeTouquet was opened for traffic, the inaugural ceremony being performed by the French Air Minister. The new terminal is within a mile of the center of LeTouquet, whereas previously air traffic to and from this resort had to be handled at the outlying field at Berck. New facilities mean that airway journeys from Croydon to the heart of LeTouquet, are now completed in less than an hour.

A new service, started by Air France on July 1, makes it possible to leave Paris in the morning and arrive in Stockholm late the same afternoon after a 9-hour flight. Stops are made at Brussels, Hamburg and at Malmo.

At present most French manufacturers are making efforts to develop a small, inexpensive plane. Farman has just built one called *Moustique*, which will sell for the equivalent of about $843 after deduction of the premium granted by the Air Ministry. It is a one-place monoplane, with an all-wood fuselage, and is powered by a four-cylinder, 30 hp Aba engine.

Service between Paris and Madagascar, a mail run since early in November, 1935, has been opened to passengers. Fare amounts to about $660, the flight between Paris and Tananarive requiring 8½ days. Overnight stops are made at Algiers, Aoulef, Niamey, Fort Lamy, Coquilhatville, Luluabourg, Elizabethville and Mozambique.

Great Britain

With opening of Gatwick Airport, London's newest field was put into practical operation by British Airways, Ltd., whose principal services extend to France, Germany and Scandinavia. Isle of Wight service, heretofore operating from Heston, has also trans-

(Continued on following page)

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(*Continued from preceding page*)

ferred to Gatwick. Equipment includes three large hangars, repair shops, garages, a sizeable administration building and a new railway station connected by a tunnel with the administration building to provide exits from which six airliners can be served simultaneously.

Plans are ready for the construction of a combined land and marine base for Imperial Airways operations at Portsmouth. Although final details remain to be worked out, it is understood that the equivalent of about $5,574,250 would be required to acquire the land and make the improvements necessary for an air base suitable for all purposes projected. Provision would be made for buoys for aircraft, a slipway and considerable hangar space. Dredging of two runways in the harbor will be undertaken soon in order that the base be in partial service by January 1. Completion is expected to take a number of years and the main outlay will come to approximately $4,217,500, of which $1,350,000 will be spent in the next two years.

Flying at an average speed of 164.5 mph, Charles Gardner won the 1936 race for the King's Cup. His plane was a standard Percival *Vega Gull* low-wing cabin monoplane. Second was Flight-Lieutenant T. Rose, last year's winner, who averaged 184.5 mph in a Miles *Hawk-Six*. E. W. Percival flew the fastest craft in the race, the Mew Gull, entered by the Duke of Kent, at an average speed of 203 mph. On the penultimate and last laps of the 25.5 mile circuit he recorded 211 mph, a record lap speed in a King's Cup race.

Latest British plane designed specially for army cooperation flying, including artillery-spotting, reconnaissance, photography and low bombing is the Westland strut-braced monoplane shown for the first time at the RAF Display on June 27. The new plane is powered with a Bristol Mercury.

Sir Robert McLean, of Vickers, Ltd., was reappointed chairman of the Society of British Aircraft Constructors, a post to which he was elected a year ago. F. S. Spriggs, of Hawker - Siddeley, became Deputy Chairman (Aircraft) succeeding Hugh Burroughes, of Gloster. Air Vice-Marshal A. E. Borton, of D. Napier and Son, Ltd., was appointed Deputy Chairman (Engines) and R. H. Dobson, of Avro, was elected treasurer.

Changes in command and administration of Royal Air Force, put into effect this month, eliminated Headquarters, Air Defence of Great Britain. Its functions are now vested in three operational commands—the Bomber Command, the Fighter Command, and the Coastal Command. These commands will be responsible for all tactical and strategical air operations required to protect the country from attack. A new Training Command will control, with few exceptions, all of the training units at home.

Mercury-powered Westland designed for army cooperation work with RAF

Canopus, first of 29 four-engined flying-boats which the Short company is building for Imperial Airways, successfully completed initial water and flight tests at River Medway, with J. Lankester Parker, the company's chief test pilot, in charge.

Four thousand persons were guests of the Society of British Aircraft Constructors at the Fifth Flying Display and Exhibition, at Hatfield. On exhibition were twenty-eight different types of aircraft, including some of the most modern British military machines, as well as engines, parts, materials, instruments and accessory equipment, showing the products of ninety-three firms which are members of the Society.

Fifty percent increase in plane mileage, operation of more lines, addition of faster and larger planes, reduced flying times and new routes are among plans developed by Railway Air Services to attract a larger volume of passenger traffic. Railway Air Services is an operating company controlled by four railways and Imperial Airways. Operating plans, recently announced, call for an extension and acceleration of service to include increased flying by 400,000 miles, making a total of one million miles in 1936, compared with 600,000 in 1935.

Holland

Royal Dutch Air Lines are considering a 48-hour schedule on the Europe - Singapore - Batavia run. At present Douglas planes take 55 flying hours, but with improvement in ground organization and night flying a 7-hour saving will be possible. On the Amsterdam-Batavia run K.L.M. is now making Penang a regular port of call instead of Alor Star.

Service between Batavia and Balikpapan (Borneo) is to be extended soon to Tarakan in the northern part of Netherland Borneo, where a new airport is ready. This brings the terminus of this line within 400 miles of Zamboanga in the Philippines. Proposed lines of K.N.I.L.M. from Batavia to Manila has now been extended to the limits of Netherland Territory.

Royal Dutch Air Line reports air mail between Amsterdam and Batavia increased 29.5 percent from January 1 to April 1, 1936, and passenger traffic increased 159.7 percent during the period. Planes are now flying the summer route through central Europe.

Japan

Japan's Communications Ministry placed about $98,770 in its working budget for the fiscal year ending March 31, 1937, for improving weather forecasting facilities. Meteorological stations are projected for Tomie, Nagasaki, Ishigaki Island and in the prefectures of Okinawa and Miyazaki. At the same time the communications office of the Formosan Government is considering the creation of an aviation section to assist the new air line from Japan and the projected link with Bangkok, as well as to encourage student pilots.

Spain

Spanish government has approved and will contribute 35 percent of the cost of building a new airport at Tenerife, which the Insular Government plans to replace the present field where unsatisfactory meteorological conditions are too frequently encountered. The new field will also be much nearer the island's capital and principal port. Work will begin as soon as funds are available and is expected to be finished within a year from the starting date.

Latin America

Special appropriation equivalent to about $496,500 has been made available to the Argentine Civil Aviation Department, although Congress will be asked to increase the sum to the equivalent of $662,000. Money will help develop internal air routes, improve present ground facilities, and purchase training planes and equipment for clubs.

Brazil's 1935 purchases of airplanes nearly tripled those of 1934. Imports from the United States totaled 78 units valued at $581,914, from Great Britain, 15 units worth $109,521 and from Germany 4 units valued at $335,355. Total for aircraft imports was $1,026,790 compared with $371,595 in 1934. United States also led other countries in sales of engines, parts and accessories, total being $379,815 out of a possible $574,069.

Organization of a military school of aviation in Honduras, with Major William C. Brooks as director and the purchase of 8 new-type American airplanes, was announced.

Aerolloyd Iguassu, which started service between Curityba and Sao Paulo during Sept., 1933, and later opened lines connecting Curityba and Joinville and Blumenau has suspended operations. It appears no attempt will be made to resume operations until some financial aid is obtained for the construction of needed emergency landing fields and for additional equipment.

Chilean Director of Civil Aeronautics has been authorized to purchase a specified tract in Quilpue, near Valparaiso, at a cost of about $22,969, for airport purposes.

Lineas Aereas del Balsas extended service to include the route from Mexico to Huetamo in the State of Michoacan. Company has been operating passenger service between Huetamo and Morelia in the State of Michoacan.

Paitilla Airport, which serves Panama City, will shortly be improved by the construction of a concrete and macadamized asphalt runway 2,600 ft. long and 126 ft. wide. Plans are also being considered for construction of an administration building and a modern hangar, work expected to start before the end of the year.

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CURTISS-WRIGHT GRADUATES SECURE IMMEDIATE EMPLOYMENT

Norman A. Faber, of Los Angeles, Calif., says: Upon graduating from your aeronautical engineering course I was placed with the Lockheed Aircraft Corporation. Work became slack. Naturally a cut in personnel followed. While other men received the usual lay off I was transferred to Templates due to thorough training obtained while attending Curtiss-Wright Tech

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"45"
PERSONAL TRANSPORT

FAIRCHILD AIRCRAFT CORP., HAGERSTOWN, MD.

STANAVO

AVIATION GASOLINE
AVIATION OIL
ROCKER ARM GREASE

AIR—HOT AND OTHERWISE

(*Continued from page* 21)

these suits with $601,511 of the taxpayers' money, Senator Warren R. Austin of Vermont, said: "the logical conclusion of the New Deal attempt to annul those contracts and enforce statutory penalties on contractors innocent of any violation of law."

"The settlement," Senator Austin continued, "is an important piece of evidence to consider with the statement of Attorney General Homer S. Cummings that it was based on the report of the inspectors. In other words, Senator Austin referred to what is known as the Ristine report, which the Post Office Department has steadily declined to make public but is understood to 'clear the airlines of any actual violation of law in negotiating the contracts during the Hoover administration.'

"The contractors had been branded publicly as guilty of fraud and collusion.

"Annulment could be made only after notice and an opportunity to be heard. These contractors had no notice, but upon learning of the intended cancellation indirectly, asked for an opportunity to be heard and were denied it. Not even the conscience of the sovereign was active in this situation. The law was overridden, good name, freedom of contract and property rights were ruthlessly destroyed, not only giving a right of action against the government in the Court of Claims, but revealing the arbitrary character of the government under the New Deal. This was cause for fear of government by the people. This raised doubts of the integrity of any and all contracts with the government.

"This was an early example of the danger the citizen is exposed to when the Administration overrides the law, and men, rather than laws, rule. The independence of courts of justice is the only protection left to the citizen in such circumstances. The taxpayers pay the bill in money and in evil effects that flow from such precedents of sheer force in government."

This Roosevelt-Farley combination in the handling of the aeronautic industry during the past three years shows a record of broken promises, dishonored agreements — government interference — incompetence—malicious and vicious politics—ignorance—yet, voters of the aeronautic industry, Roosevelt and Farley in the face of this record ask you to give them four years more in which to further foist their ruthless and despicable policies on your industry. Four years is more than enough; it is just four too many.

Vote in November so as to free our industry from political parasites.

FUEL INJECTION

(*Continued from page* 48)

the full accelerating ability of the engine on every occasion.

As used in the Type B equipment, the sylphon was not an aneroid, consequently, it was only sensitive to a change in manifold pressure relative to external atmospheric pressure. If the sylphon is sealed at sea level, it becomes an aneroid and sensitive to changes in manifold pressure relative to sea level pressure. The unit then becomes a combined manifold pressure and mixture control regulator capable of maintaining nearly constant manifold pressure and air/fuel ratio up to the critical altitude of the engine for any fixed throttle position. For altitudes greater than the critical, a manually operated mixture control must be provided since the air throttle would be open against the stop. If the engine can be operated at full air throttle at sea level the pump mixture control would have to be adjusted at each altitude. In such an engine, the sylphon would only become operative at part throttle positions and have characteristics similar to those obtained on the *B* engine, except that it would maintain any part throttle manifold pressure with increase in altitude until the air throttle was fully open.

The above types of controls do not compensate for change in intake air temperature, but such compensating mechanism could be developed. An ideal automatic control might be developed by utilizing the manifold pressure or cylinder pressure to determine the injection pump stroke.

Conclusion

No new development or principle is adopted unless there are advantages to be gained from its use. The slow development of injection up to the War undoubtedly was due to the fact that the carburetor satisfactorily filled the requirements of engines of that period. However, recent interest in the principle is evidence that some of its inherently favorable attributes and possibilities are not possessed by the carburetor. On a weight basis, there is little to choose between the two, and at present there may be no justification for applying injection to present aircraft engines merely on the basis of its demonstrated advantages over carburetion. However, the principle deserves the consideration of the industry on its possible future application.

PERSONAIRLITIES

(*Continued from page* 66)

Ontario, from the borders of Quebec to those of Manitoba and as far North as James Bay. In 1927 Brintnell and the late Fred Stevenson joined Western Canada Airways staff under Doc. Oaks. That was the year when aerial mineral exploration started in the unsettled northern parts of Quebec, Ontario, and Manitoba. Leigh would fly food and supplies to the different camps, and carry miners and prospectors into and out of the wilderness. With Stevenson he flew the first 15 tons of freight to the Sherritt Gordon Camp in Northern Manitoba, and carried men and mining supplies as well.

In 1928, Leigh was placed in executive charge of Western Canada Airways, not only directing operations, but flying himself. He and his pilots were flying everywhere — Chesterfield Inlet, Baker Lake, Great Slave Lake, Bathurst Inlet, Coppermine River, and Great Bear Lake, right up to the Arctic Circle. The boom in mineral exploration was on; Canada was on the gold, silver, copper, and radium standard, and anyone who could go out and hunt himself a mine went out and hunted it. Apparently all you had to do was to fly in somewhere where the moose were so unused to seeing human beings that they would moo at you—right there you staked yourself a claim and began to wonder how in the world you'd ever spend all the money you were going to make. But whether the miner staked on a gold mine or on what turned out to be just another rock pile, the airplane people made money for flying him to where he could sit and look at his discovery, or even work it if he couldn't sell it. If it actually turned out to be a mine, they had to fly in supplies and machinery, so they had him coming and going. It was fly, walk, or paddle a canoe to those distant places; so everyone flew.

In August, 1929, Brintnell flew from Winnipeg to the Mackenzie River, for which his own company is named, and flew all around Great Bear Lake—the first pilot to do so.

Brintnell has flown from the Mackenzie to Aklavik, and from there made the first flight across the Rockies at their northern end, flying over part of Alaska and down to Dawson City, then on to Carcross, flying over Lake Labarge and White Horse, and so down to Prince Rupert and then 1000 miles through the mountains to Edmonton. There are no airways to follow in that country, and if you get lost in the sub-Arctic wilds you can't fly down and read the name of the town on the railroad station. Yet Leigh has experienced less difficulty in flying there than Dick Blythe encountered trying to get from New York to Montreal in bad weather.

Western Canada Airways was merged into Canadian Airways in 1931, and Leigh was made assistant general manager, in charge of operations west from Sault Ste. Marie to the Pacific Coast and north to the Arctic Ocean. In December of that year he resigned and organized Mackenzie Air Service, Ltd., chartered to fly anywhere in Canada. The first year's operations were in the new gold field in Swayze County, Ontario. In December, 1932, he commenced operations down the Mackenzie River Basin into Great

(*Continued on following page*)

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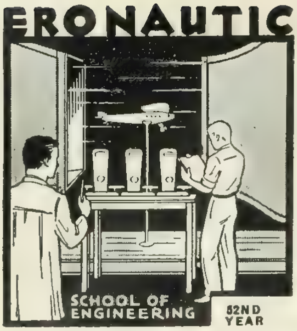

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"BETTER AIRPLANES FOR LESS"

AERONCA C-3, 2-place	$ 775
AMERICAN EAGLE, Kinner K-5	575
BELLANCA PACEMAKER, J6-9	4,500
BUHL PUP, LA-1	450
EAGLEROCK A-1, J-5	1,050
MONOCOUPE, Lambert 90	1,350
PITCAIRN, J6-7	1,850
RYAN ST, Menasco 125	3,500
SPARTAN, J6-5	1,300
TRAVEL AIR "Osprey" Speedwing B-14-B, J6-9-E	3,950
TRAVEL AIR Monoplane, J6-9-D	2,500
TRAVEL AIR Monoplane, J6-9	2,150
TRAVEL AIR 12-W, Warner 125	1,250
WACO F-3, Continental 210	3,350

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1 Pratt & Whitney Wasp SC1, 450 h.p.
Completely overhauled and fully modified; forged pistons, D cam, KE valves; no time since cylinders reground to .010", engine run in and tested. $1650

1 Pratt & Whitney Wasp B, 425 h.p.
Completely overhauled, total time 800 hrs.; all parts standard size; run in and tested.....$800

2 Wright Whirlwind R-975E, 330 h.p.
Completely overhauled and fully modified; all parts standard size; total hours 500; engine run in and tested; complete with exhaust manifold........$1950 ea.

1 Wright Whirlwind R-975E, 330 h.p.
Completely overhauled and modified; all parts standard size; total hours 700, complete with exhaust manifold; engine run in and tested..$1650

1 Continental A70, 165 h.p.
Total time 100 hours; engine just top overhauled. Complete with exhaust manifold...$650

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All classified advertisements published in the same type face, without display.

Absolute closing date for September classified advertisements—August 18th

USED PLANES

classified by makes

Aeronca

AERONCAS: Used latest models, high and low wing. Also new Aeroncas. Prices upon request. United Aero Corporation, P. O. Box 222, San Antonio, Texas.

FOR SALE: Aeronca seaplane; late '33 floats; motor majored, E-113-A, modernized; wings recovered; bargain. D. H. Franklin, 95-31 Roosevelt Avenue, Corona, L. I., New York.

COMPLETELY OVERHAULED 1934 Aeronca; enclosure. Sell, $800; trade for good standard 1930 4-place ship, Waco preferred. Frank Reiser, 19 White St., Paterson, N. J. Lam. 3-4789.

AERONCA 1935: Excellent condition; looks like 1936 model. 285 hours total time. Extra equipment includes navigation and landing lights, dual throttles, cabin heater, larger airwheels. Owner entering other business. Bargain at $1,250. Sunbury Airport, Sunbury, Pennsylvania.

1936 C-3: Perfect, 3 months old, $1,375. Aeronca low-wing, 4 months old, $2,200. Few parts for Kinner Pitcairn giro, cheap. Tred Avon Flying Service, Easton, Maryland.

'36 AERONCA MASTER: One month old. Absolutely perfect; cannot be told from new; $1,495. (Buying low-wing.) Late '34 Aeronca, $925. Wonderful condition. Will finance either ship. Al Leeward, New Kensington, Pennsylvania.

AERONCA DEMONSTRATOR: Like new: Purchased May 1935. 410 hours total time. Never damaged. Heater. $1.100, will finance. Aircraft Service, Inc., Municipal Airport, Cleveland, Ohio.

LOW WING DEMONSTRATOR: Under 100 hours total time: 3 months old and in excellent condition. Extras include bank and turn, rate of climb, air brake navigation and landing lights, and battery. Priced for immediate cash sale only. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

AERONCA C-3: Perfect condition. $700. Late Aeronca with E-113-A motor, just relicensed, $785. 1933 Aeronca, like new, $850. Terms, easy payments. Pioneer Aviation, Airport, Syracuse, New York.

C-3 AERONCA: 113-B. 250 hours. Purchased factory April 1935. Perfect. Compass, airspeed, heater, extra gas tank. Used privately. $1,150. S. N. Christensen, Airport, Red Bank, N. J.

American Eagle

AMERICAN EAGLE OX: Good shape. $250. Stevenson-Weeks Air Service, Inc., Municipal Airport, Kansas City, Missouri.

KINNER AMERICAN EAGLE: 3-place. Licensed February 1937. Recovered; motor 10 hours since majored; compass, airspeed, pitch-bank indicator; $495. Henry Hearts, 1501 Wolfe, Little Rock, Arkansas.

AMERICAN EAGLE: OX-5. $375. Licensed till May. Inquire, Earl B. Hadley, Muncie Airport, Muncie, Indiana.

AMERICAN EAGLE OXX-6: Long nose. Compass. Cowling, etc., for installation of Kinner K-5. Just relicensed. J. C. Stamper, 1 Jefferson Boulevard, Annadale, Staten Island, N. Y.

OX-5 AMERICAN EAGLE: Licensed. For sale or trade. Pay cash difference. Jack Caley, Secretary, K-12 Club, 1126 Prospect Avenue, Springfield, Missouri.

Amphibions (Privateer)

PRIVATEER AMPHIBION: 125 Warner powered; starter, metal propeller and other extras. Recently completely overhauled throughout and in excellent condition for many hours service. K. Russell Smith, 394 Wyoming Avenue, Wyoming, Pennsylvania.

Arrow

FOR SALE: Arrow Sport, 60 LeBlond. New February 1935; 25 hours total time; always hangared. Licensed till May 1937. Price, $850. I. M. Brown, 203 W. Valley Avenue, Shenandoah, Iowa.

ARROW SPORT: LeBlond 60. Duals. Licensed until June 15, 1937. $650, or will trade for LeBlond Aeromarine Klemm. Norman Wegner, Whitewater, Wisconsin.

ARROW SPORT: LeBlond 60; two-place dual. Identified. Ideal trainer. Priced to sell. Consider '34 or later car. Morris Cramer, La Crosse, Kansas.

ARROW SPORT: 10 hours since motor major; licensed to June 1937; excellent condition. Must sell; price $600. Murphy Flying Service, Kokomo, Indiana.

Avro-Avian

AVRO AVIAN biplane: Cirrus motor, duals, air wheels. Excellent. Licensed to March 1937. $500. C. H. Fosdick, 946 W. Wilcox, Peoria, Illinois.

CIRRUS AVIAN: Just completely rebuilt, recovered, relicensed. Total time, 275 hours. Finished in Waco vermilion with rubbed Loening yellow wings. Equipped with slots, duals and folding wings. Will sell for cash or consider 3-place open ship. Have spare engine and some Avian parts. James Burns, 308 East Kirby, Detroit, Michigan.

Barling (N-B)

NB-8, GENET 80: Total honest time, 246 hours. Purchased new by owner; used exclusively for private purpose. Never cracked. 37 hours on ship since complete overhaul, including Grade "A" Flightex; rubbed vermilion red fuselage, AN yellow wings; black engine ring, cowling and trimmings. New cabin or winter enclosure over cockpit. Engine recently majored. Extra instruments. Licensed until July 15, 1937. Perfect condition. This ship ideal for student work, flying clubs or private use. $775; consider trade on late model car. L. J. Hickman, 817 Menominee, Pontiac, Michigan.

NB-8 TRAINER: Brand new, never flown. 80 h.p. Genet motor. Finished blue and silver. Licensed. First cash order gets it at $1,050. Nicholas-Beazley Airplane Co., Inc., Marshall, Missouri.

Bellanca

BELLANCA PACEMAKER: Special. Powered Wright E. Turn and bank, climb indicator, large tanks. Electric starter, landing lights, flares. Total time motor, 530 hours; 30 since majored. Ship, 1100; 540 since recovered and conditioned by factory. Price, $3,000. H. A. Strickland, Candler Field, Atlanta, Georgia.

BELLANCA AIRBUS: 12-place or ten and a third payload. 575 Wright Cyclone. Color blue and yellow. Standard instruments and accessories, landing lights, extra large cargo door. Floats available for licensed seaplane conversion. Engine recently majored. Bellanca Aircraft Corporation, New Castle, Delaware.

Bird

FOR SALE: Bird 4-place; 125 Kinner, 50 hours since major. Metal propeller, Heywood starter; license expires May 1937. $1,400 cash, no less. Laurie Yonge, Municipal Airport, Jacksonville, Florida.

BIRD, KINNER 125 H.P.: Motor majored; metal prop, starter, collector ring, air wheels, new Goodrich tires, duals, brakes both cockpits; entire ship excellent; licensed July 1937. With R C A radio, $1,850. Without radio, $1,700. Hal Emrick, Central Airport, Camden, N. J.

KINNER BIRD: K-5, front exhaust. Motor and airplane excellent shape; collector ring, Pioneer instruments, semi-airwheels, brakes, metal cockpit cover, navigation lights. Richard Sanders, 2612 Tilden Street, Washington, D. C.

BIRD, 125 h.p. Warner: Excellent condition, dual control. Aerol struts, streamline tires; a real buy for $1,495. Sundorph Aeronautical Corp., Cleveland Airport, Cleveland, Ohio.

Buhl

BULL PUP: Licensed; exceptionally good clean condition; never cracked; looks like new; car considered; $400. Dale Kalmbach, 1022 Starr Avenue, Toledo, Ohio.

BULL PUP: Just majored, relicensed, excellent condition. Best offer or trade. L. E. Dufty, 1703 St. Paul Street, Baltimore, Maryland.

Cessna

CESSNA C-34 Demonstrator: 130 hours total time; no time on engine since factory major. Turn and bank, rate of climb, flares, Grimes landing lights, air wheels. Best offer over $4,000. Terms and trade. Airplane Sales Corporation, Robertson, Missouri.

J-5 CESSNA: Newly recovered, full airwheels, brakes, air tail wheel, speed ring. If you want a fast cabin airplane for cross-country, here it is and the price is right. Trades considered; terms to responsible buyers. Edward A. Forner, Jackson, Michigan.

NEW CESSNA DEMONSTRATOR: 145 h.p. Warner. Extra equipment: turn and bank, rate of climb, R C A radio, retractable landing lights; $4,500. Sundorph Aeronautical Corp., Cleveland Airport, Cleveland, Ohio.

Command-Aire

COMMAND-AIRE: 3-place. 150 h.p. Hisso. Licensed until May 1937. New Bendix wheels. 100 hours since fuselage and tail group recovered, new engine installed and steel prop etched. Must sell. $500 cash. Mickey McCrocklin, Bowman Field, Louisville, Kentucky.

WARNER COMMAND-AIRE: 3POLB. Metal prop, compass; licensed. Priced low, or trade for Great Lakes, Franklin or other 2POLB. LeBlond 60 and 90, $100 each. Whitehurst, Hornsby, Tennessee.

CHALLENGER COMMAND-AIRE: Excellent condition. Steel prop, starter, Bendix wheels, brakes. Majored year ago. Privately owned, hangared. Priced right for quick sale. Write, wire or visit Jersey Air Service, Paterson, New Jersey.

Crawford

CRAWFORD MONOPLANE: LeRhone 80. New, identified; dual controls, airspeed, altimeter, tachometer, complete except covering; $150. This is a bargain. John Bliem, 242 Chestnut, Pottstown, Pennsylvania.

Cub

TAYLOR CUB: New June 1934. Good condition; $800. Can be financed or trade for heavier ship. H. Maurer, 6838 South Peoria Street, Chicago, Illinois.

1935 TAYLOR CUB: Continental powered. Excellent condition. Like new. Fuselage maroon with silver stripes, silver wings. Will sacrifice. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

TAYLOR CUB: A-40-2; $625. Good condition throughout; enclosure; best Cub on the market at anywhere close to the price. Somerset Hills Airport, Basking Ridge, New Jersey.

SIX 1935 CONTINENTAL A-43 Taylor Cubs: All equipped with winter enclosures and in A-1 condition. Closing out for later model. Prices from $895 to $1,025. Time payments can be arranged on these ships. Ray P. Hylan, Municipal Airport, Rochester, New York.

A FEW GOOD 1935 Cubs still available. $850 up. Can be financed. Take this opportunity to get a plane of your own, your start in aviation. Free instruction to purchasers. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

1935 CUB: Licensed till May 1937. Under 400 hours total; 200 since major, 25 since top overhauls. Winter enclosure; never cracked; in A-1 shape. Price, $875 cash. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

TAYLOR CUB: 1935 Model. A-40-3 engine; good condition throughout, with winter enclosure, $795. Louisville Flying Service, Inc., Bowman Field, Louisville, Kentucky.

TAYLOR CUB: 1935. A-40-3 Continental motor. Licensed to August 1937. Perfect condition, never damaged. Equipped with winter enclosure, navigation lights, bank indicator and air speed indicator. $950 cash or may be financed. K. Russell Smith, 394 Wyoming Avenue, Wyoming, Pennsylvania.

CUB: Good, privately owned, licensed; Model E-2 Continental Cub with enclosure, compass, etc. Priced $900 at duPont Airport, Wilmington, Delaware. Might trade on 2-place Warner Fairchild "24".

TAYLOR CUB: Aeromarine engine; with winter enclosure; excellent performance; new June 1934. 325 hours total time. Just relicensed. $850. AERO DIGEST, Box 2374.

Curtiss Jr.

CURTISS JUNIOR: Good Condition, $350. Also Waco 90 parts, wing, radiator, fittings and spars. Fred M. Roberts, Jr., Bismarck, North Dakota.

CURTISS JUNIOR: Licensed; new covering; always hangared; motor majored; new prop, navigation lights, air wheels. $425 or trade. Jim Haun, 919 Roland Street, Memphis, Tennessee.

Curtiss Robin

OX ROBIN: Model B-2. Just relicensed; recovered 1935; refinished last month. Steel prop, airspeed, new safety glass, upholstering and other improvements. Price $570. Olav Fostervold, Route 3, Willmar, Minnesota.

FOR SALE: Tank Robin, 3PLCM; lights, air wheels; licensed till December. Tail group just recovered. $650. "Red" Martin, Box 37, Lake City, Florida.

CURTISS ROBIN: OX-5. Licensed. Ship and motor in A-1 condition. Will take late model car in trade. Price, $550. E. M. Jones, Cold Spring, Minnesota.

CURTISS ROBIN: OX-5. Recovered, Millerized, Scintilla, large wheels; just relicensed. $495. Trade for Aeronca, Cub, NB-8. Pay small difference. Gilbert Reineke, Route 2, Waseca, Minnesota.

CHALLENGER ROBIN: 4-place. Excellent condition. Brakes, tail wheel, starter, safety glass throughout, new upholstery, refinished. Price $1,250. Consider trade. Dick Schall, Berwyn, Maryland.

OX ROBIN: Late model; excellent motor; black fuselage, yellow wings; new prop; large wheels; $550. Edgar Cate, 164 Frances Street, Portland, Maine. Trade for small plane.

CHALLENGER ROBIN: Just completely recovered and relicensed, 480 hours total time; 10 hours since motor was majored. Beautiful high-gloss paint job of red and cream. Price: $1,095. Rankin, 2938 N.E. Union Avenue, Portland, Oregon.

CHALLENGER ROBIN: Motor and ship excellent condition. Duals, compass, airspeed, clock, brakes and starter. Will consider smaller first-class ship trade. Wm. J. Ray, 315 Broadway, Buffalo, New York.

TANK ROBIN: Licensed; motor 40 hours; new tires, covering, upholstering; Pioneer compass and airspeed. Ship like new; $850. Stevenson-Weeks Air Service, Municipal Airport, Kansas City, Missouri.

CHALLENGER ROBIN: Seaplane-Landplane: Reconditioned Edo 3300 floats, new struts, rudder gear. Motor 80 hours since major; battery, lights, starter. Landing gear in A-1 shape. A de luxe airplane; no reasonable offer refused. J. A. Wales, Jr., 230 Park Avenue, New York, N. Y.

Curtiss-Wright

CURTISS-WRIGHT J6-5 16E Seaplane: Perfect condition; total motor and ship time only 280 hours. Price $2,200, including wheel undercarriage. Shobe Airlines, Inc., Boston Municipal Airport, East Boston, Massachusetts.

FOR SALE: Curtiss-Wright Sport 16-E. 3-place. Last 16-E model built. Serial 3520. Total time on Wright J6-5-E, 285 hours. Top overhaul at 215 hours. Eclipse starter, booster, generator, navigation lights, carburetor air temp., turn and bank, rate of climb, new compass. Propeller reconditioned July 20th. Relicensed to July 15, 1936. C. R. Rust, Two Harbors, Minnesota.

Davis

DAVIS KINNER: Ship and motor completely overhauled. Fastest and best flying small ship in country. $1,000. Stevenson-Weeks Air Service, Municipal Airport, Kansas City, Missouri.

Driggs

DRIGGS SKYLARK: Gipsy powered; brakes, Airwheels, airspeed, compass. Like new condition. Stored at Grand Rapids Airport. Priced for cash; no trade deal. Ivan Pownall, Traverse City, Michigan.

DRIGGS SKYLARK: Built 1932; Rover inverted engine, just majored. Ship overhauled and in A-1 condition. Economical sport or trainer. Bargain, $850. Ray P. Hylan, Rochester Airport, Rochester, New York.

Eaglerock

OX-5 CENTER SECTION Eaglerock: $325. Condition excellent. New motor and prop. Spare motor, Bendix plate wheels, dual controls. Always hangared. Licensed to July 1937. Deliver for expenses. Write or wire Jack E. Hardy, Beach, North Dakota.

EAGLEROCK A-3: Hisso E, 180 h.p. Good condition. Licensed May 15, 1937. Good spare motor; stressed for J-5. Micarta adjustable pitch prop, Bendix brakes; real performer. Good for smoke writing. Always hangared. $650 cash. Ray Grenzow, 1204 Akron Savings & Loan Building, Akron, Ohio.

KINNER A-2 EAGLEROCK: Motor majored; fuselage recovered; high gloss finish. Cowling, wings refinished. 30 x 5 wheels, tires; new Story propeller. Complete less cover for right upper panel and a right lower panel. Many spare parts; ailerons, elevators, etc. All, $400. Must be seen. Mankato Aero Service, Mankato, Minnesota.

KINNER EAGLEROCK: Motor and fabric good condition; asking $750 as is, flyaway; inspect this Eaglerock and make us an offer. Pioneer Aviation, Airport, Syracuse, New York.

Fairchild

CHALLENGER KR-31: OX-5 motor. Extra motor and parts. Motor recently overhauled. Licensed January 1937. Motor, ship, A-1 shape. Price $425. Nick Hornick, care Burke's Store, Clearfield, Pennsylvania.

FAIRCHILD 24 C-8-C: Serial 2678; NC15041. Warner 145 engine. Extra equipment. Factory majored this year; good condition. $2,650 cash. Call 1102. Mrs. M. M. Barrett, Center St., Winder, Georgia.

3-PLACE FAIRCHILD 24: 145 h.p. Warner. Total time 459 hours; only 9 hours since complete major overhaul. $2,750. H. N. Holifield, 5829 Oram St., Dallas, Texas.

FAIRCHILD 24: Three-place cabin; Ranger motor, 40 hours; perfect condition. Never scratched; bought new November 1935. Best reason for selling. F. D. Kessler, Northumberland, Pennsylvania. Phone 1750.

FAIRCHILD KR-31 OX-5: Motor just majored, Scintilla magneto; turns 1500. Airwheels, steerable tail skid. License expires December 1, 1936. Robert O'Connor, Williamsport Airport, Montoursville, Pennsylvania.

FAIRCHILD 24: With flaps. Available October first, fully equipped, almost new. Bargain. AERO DIGEST, Box 2366.

FAIRCHILD 24: 1935. 145 Warner. Total 130 hours. Like new. Finished vermilion and cream. Flaps; turn and climb indicators. $4,700. Warren White, Albany Airport, Albany, New York.

FOR SALE: Ranger Fairchild 24. Good as new. Flown only 160 hours. Blue fuselage with yellow wings and trim. Equipped with radio, landing lights and radio shielding. Price, $4,400, at duPont Airport, Wilmington, Delaware.

FAIRCHILD 24: Cirrus. New August 1933. 400 hours total time. Just relicensed. Exceptional condition. Will sell or trade for 3-place open job. AERO DIGEST, Box 2375.

FAIRCHILD KR-21: Taper wings, perfect condition; fuselage recovered; licensed February '37. 100 h.p. late type front exhaust Kinner, 200 hours total time. $975. Used Kinner B-5 heads. L. T. Childress, 2414 Orange Ave., N. W., Roanoke, Virginia.

Fleet

FLEET: Kinner front exhaust; full airwheels, brakes, air starter. Motor time, 70 hours since major. Covering good. $1,375. John S. Mekeel, care White Flying Service, Caldwell, New Jersey.

Ford

FORD TRIMOTOR J6-9: Perfect condition; total time 805 hours. Equipped with changeable in flight night sky sign. $4,800. Link Aeronautical Corp., Binghamton, New York.

Flamingo

FLAMINGO: All metal 8-place cabin monoplane with Wasp C engine, starter, generator, night and blind flying equipment; total time 350 hours; $1,950. Will consider smaller plane in trade. Louisville Flying Service, Inc., Bowman Field, Louisville, Kentucky.

Great Lakes

LATE MODEL de luxe Great Lakes: No time since complete overhaul. Total ship time, 1000 hours; engine, 400 hours. $1,100 cash, no trades. John S. Ray, Millwood, New York.

GREAT LAKES DE LUXE: Inverted, 2T1E. High lustre finish, steel propeller, full air wheels and brakes, $500 worth extra equipment. 15 hours since complete major overhaul to motor and ship. Licensed until November 6, 1936. Price, $1,450. E. M. Summers, 2607 Edmondson Avenue, Baltimore, Maryland.

GREAT LAKES 2T1A: Cirrus, majored 30 hours; fabric, finish excellent; airwheels; one owner; always hangared. Cash or trade, $1,200. Joe Dawley, 407 Broad Street, Conneaut, Ohio.

GREAT LAKES CIRRUS: Just relicensed to July 1937. Always hangared and privately owned. Never cracked. Excellent condition. 410 hours certified time. Airwheels, special paint job. Must be seen to be appreciated. Bargain, $950 cash. Jerry Church, 2300 Rugby Row, Madison, Wisconsin.

Heath

HEATH LN-B-4: Licensed. Total flying time, 155 hours. Wings and tail surface just recovered. Price, $395. Sam Egnot, 236 East Second St., Erie, Pennsylvania.

Inland

INLAND SPORT: 2POLM; side by side; LeBlond 65; NC licensed June 15, 1937. Time under 300 hours, ship and engine; needs no work. Price $750, cash only; no trades. J. B. Dahl, 3661 Archer Avenue, Chicago, Illinois.

Kinner

KINNER PLAYBOY: 2PCLM. Kinner's 1936 show job; total engine time, 136 hours. Airplane time, 218 hours. Beautiful finish; many extras. Ship only 7 months old. Price $3,200. Will accept trades or finance. Cessna Aircraft Co., Wichita, Kansas.

Lambert

VELIE MONOCOUPE: Licensed April 15, 1937. 125 hours total on motor; ship in good condition. Will sell for $550. Raymond Daggett, Sheldon, Iowa.

LAMBERT MONOCOUPE: De luxe late 1935; flaps, tunnel cowl, pants, parking brakes, duals, clock, lights, tailwheel, less than 150 hours. Condition perfect. $2,475 cash. Lt. Col. C. F. Williams, Miami, Oklahoma.

MONOPREP: Velie M-5. Identified. Has winter enclosure, new Gardner prop; 4 hours since top overhaul. Always hangared. Price, $275 cash. Monarch OX-5; Licensed till August 12, 1936. Has steel prop. 3-place biplane. Price, $300. Rock County Airport, Janesville, Wisconsin.

MONOCOUPE D-145: Warner. Cruises 140, top 160; tunnel cowl, pants, fully streamlined; complete instruments; $2,500 cash or will trade. William Miller, Hangar 3, Floyd Bennett Field, Brooklyn, New York.

VELIE MONOPREP: Just relicensed. Good shape. Steel prop, new tires, pyralin. $400. At Curtiss-Wright, Milwaukee. Write E. Wadsworth, University Club, Milwaukee, Wisconsin.

LAMBERT MONOCOUPE: Total time 270 hours. Ship and engine excellent condition. Privately flown, never damaged, always hangared. Special colors: Stinson green and Vesta yellow. Steel propeller, oleo gear. Best offer over $1,600. George E. Dickson, 5714 Northumberland Street, Pittsburgh, Pennsylvania.

WARNER MONOSPORT: Fully equipped. Has wheel pants, ring, full wing streamlining; for quick sale, $1,185. Terms arranged. Easy payments. Pioneer Aviation Co., Airport, Syracuse, N. Y.

MONOCOUPE WARNER 125 H.P.: Ship just refinished like new; steel prop, speed ring, wheel pants. A real bargain at $1,795. Sundorph Aeronautical Corp., Cleveland Airport, Cleveland, Ohio.

DE LUXE LAMBERT MONOCOUPE: 11 months old. 125 hours total time. Never been damaged; no blemishes and in perfect condition. Color, blue and cream. $2,600, cash, no trades. Armin Richard, Box 33, Lafayette, Indiana.

Loening

LOENING COMMUTER AMPHIBION: J6-9-E motor. Total time since complete rebuild by Air Associates, 56 hours. Same since complete recovery. Total time on ship, 225 hours. You may find a cheaper one but not a better one. Clifford Condit, Aviation Country Club, Mt. Prospect, Illinois.

LOENING AIR YACHT: Dismantled. Loening Commuter, A-1 condition. 225 h.p. Jacobs Beechcraft, fully equipped. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

LOENING COMMUTER AMPHIBION: Latest one built; less 200 hours total time. J6-9-D; beautiful condition. $3,500. Douglas Burton, Lake George, New York.

Moth

GIPSY MOTH: 30 hours since motor completely overhauled. Equipped wing slots, airwheels. Always hangared; operated by private owner. Priced for immediate sale, $650. Gabe Mosenfelder, 1709 Second Avenue, Rock Island, Illinois.

DH GIPSY MOTH: Just relicensed; slots, compass, airspeed, duals, oleo, telephone. Ship, motor, in perfect condition. Sell, $625 or trade for Aeronca or similar. Sadi Fajardo, 159 West 66th Street, New York, N. Y.

DH MOTH: Wright Gipsy motor. Total time ship and engine, 470 hours. Wings and empennage recently refinished. Goodyear Airwheels. Licensed. Good condition and a real buy: $750. Nicholas-Beazley Airplane Co., Inc., Marshall, Missouri.

New Standard

NEW STANDARD TRAINER: Kinner just majored; airplane refinished, like new. Licensed until July 1937. Cash or finance, no trades. Sansom, 157 Charter Oak Avenue, Hartford, Conn.

Pitcairn Autogiro

PITCAIRN AUTOGIRO PA-24: 2-place, with K-5 Kinner 160 h.p.; excellent shape, splendid performance. $1,500 cash or trade on good J-5 job or similar, preferably in the speedwing class. Hugelen Flying Service, Forest City, Iowa.

Pitcairn

PITCAIRN MAILWING: 3-place open biplane. Wright J6-7-E motor; 50 hours since majored at factory. New covering; high gloss finish. Licensed to July 1937. Fully equipped for night and blind flying. Radio, Sperry horizon, Kollsman sensitive altimeter, Pioneer bank and turn, rate of climb, compass, airspeed, clock, electric starter and generator, retractable landing lights, flares, duals. A real ship. $1,775. Will deliver anywhere for expenses. May consider trade or time payments. John Herner, 933 Franklin Avenue, Brooklyn, New York.

PITCAIRN PA-6 SPORTWING: Wright Whirlwind motor, Goodyear Airwheels and brakes; ship and motor just major overhauled. For sale at a bargain. Sundorph Aeronautical Corp., Cleveland Airport, Cleveland, Ohio.

PITCAIRN Sport Mailwing PA-7: Will sell or trade. Total time 90 hours. Late J-5, 90 hours since major. Waxed finish. Duals, turn and bank, two altimeters, compass, automatic fire extinguisher, Eclipse inertia starter, holder for two flares. Cruises 120. Noble Mills, 3707 39th Street, Long Island City, N. Y. STillwell 4-0998.

Porterfield

PORTERFIELD 70: Excellent condition, ready to be flown anywhere. No trades. $1,150 cash. J. Sessums, Patterson Field, Fairfield, Ohio.

PORTERFIELD: '36 model, LeBlond 70. Exactly like new; has air speed, brakes, speed ring, etc.; 70 hours. Centrally located. $1,595. AERO DIGEST, Box 2362.

Rearwin

REARWIN SPORTSTER: LeBlond 70. Ring, compass, airspeed, pitch and bank indicator, special paint and upholstery, carb heater, streamline tires, latest Bendix brakes; slightly over 100 hours, ship practically new. $1,800 cash, or terms to responsible buyer. Owner buying larger ship. Bill Rochford, First National Bank Building, St. Paul, Minnesota.

REARWIN SPORTSTER: LeBlond 70; only six weeks old; less than 100 hours; condition as new. Has compass, brakes, airspeed; priced right for immediate sale. Wire AERO DIGEST, Box 2355.

REARWIN SPORTSTERS: Landplane and seaplane demonstrators, for sale at attractive prices. Act quickly. Wire or phone Cape Cod Seaplanes, Inc., North Falmouth, Massachusetts.

REARWIN SPORTSTER: 85 h.p. LeBlond. Manufactured April 1936. Total time, 125 hours. Yellow hand-rubbed finish, olive trim. Corrosion-proofed for salt-water seaplane use. Stainless cables throughout. Extras include speed ring, ball bank, clock, compass, airspeed, brakes, engine compartment fire extinguisher, tail wheel. Like new throughout. Original cost over $2,900. Offered at great sacrifice. AERO DIGEST, Box 2363.

Ryan

RYAN SPEEDSTER P-2A: Cracked up by a storm; good conditioned motor; total time since new, 325 hours. Cash. Cass Szmagaj, 5281 Cecil St., Detroit, Michigan.

RYAN B-1: J-5. Electric starter, retractable landing lights, 12-volt battery, airspeed, bank turn, rate climb, large tail group; rubbed finish; $1,250 cash or will trade on Tank powered Waco, Travel Air or any air-cooled plane under 200 h.p. Elwyn West, Route 3, Appleton, Wisconsin.

RYAN B-1: 5-place J-5 monoplane, completely recovered. Royal blue velour original upholstering, without a stain or tear. Beautiful, economical, fast cross-country ship; price, $1,600; $500 down, balance monthly from earnings. Also have J6-7 Wright motor to offer on finance plan. Aviation Finance Co., Hemlock, New York.

Savoia-Marchetti

TWIN HULL. Savoia-Marchetti flying boats; 5500 lb. useful load. Two now in dead storage, must be sold. Can be NC licensed after overhaul. Sacrifice, $500 each. Edwin R. Closs, Lake Mohawk, Sparta, New Jersey.

Security National

SECURITY AIRSTER: 2-place low-wing monoplane; 100 h.p. Kinner K-5 engine; price, $1,600. Leech Aircraft, Inc., Westchester Airport, Armonk Village, New York.

Spartan

3-PLACE SPARTAN J6-5: Just refinished. Standard instruments, lights, etc. $200, amphibion as part payment. Knapper's Flying Service, Philipsburg, Pennsylvania.

SPARTAN J6-5: Same as new. Brakes, steel prop, compass, turn and bank, airspeed; 65 gallon gas tanks; cruises 100. Plenty of baggage room. A real bargain, $1,000. Everett Litton, Woodhull, Illinois.

SPARTAN 3POLB: Licensed. 120 h.p. Walters, just overhauled. Hamilton propeller, just reconditioned. Full Airwheels, duals. Finish good. Excellent for passenger hopping. Low down payment or late model car in trade. Balance easy terms. M. R. Burgman, Clarksburg, West Virginia.

States

STATES MONOPLANE: Wings and tail section slightly damaged. Rover motor and extra parts, 20 hours since majored. Best offer considered. Dike Johnson, 622 Shiloh Boulevard, Zion, Illinois.

STATES MONOPLANE: Kinner 125, Hamilton steel propeller, oleo shocks, air wheels, brakes, interchangeable skid or tailwheel, navigation lights. Total time, 102 hours. Excellent performance, perfect condition. Best buy in the East; $1,475. Arthur Beaudoin, Box 237, Leominster, Massachusetts.

Star

FOR SALE OR TRADE: Licensed Velie Cavalier; good condition; cheap to operate; ready to fly away. Prefer Robin. Must be licensed. Grady Montgomery, Jackson, Tennessee.

LAMBERT CAVALIER: Cruises 100. Wheel pants, speed ring, shielded for radio, brakes. Color, red and silver. Perfect condition. Licensed; $800. John Warren, 24 South Sixth Street, Newark, New Jersey.

STAR CAVALIER: Lambert: licensed; air speed, compass, rubber motor mount; engine and ship in excellent condition. $950. W. E. Widmer, Excelsior Springs, Missouri.

Stearman

J-5 STEARMAN C-3-B; 10 hours since rebuilt, recovered and completely reconditioned and majored. Absolutely one of the cleanest Stearmans in the country. Semi-air wheels, latest type instruments. Black fuselage, Stearman vermilion wings. Latest model J-5 built at Wright factory. $2,000; no terms. Trade accepted on lighter ship. Marshall Purvis, Attorney, Hot Springs, Arkansas.

Stinson

STINSON FOR SALE: 4-place cabin Stinson Model SM-2AA, serial number 1057, powered Wright J6-5; just relicensed and thoroughly overhauled; privately owned. Price $750 cash. John S. McRae, South Boston, Virginia.

STINSON: 4PCLM, late 1934 Model SR. Flaps and many extras. Superb condition; always privately owned. Total time, 440 hours. Price $3,500; will accept trades or finance. Cessna Aircraft Co., Wichita, Kansas.

STINSON 33 RELIANT: Just relicensed, A-1 condition. 70 gal. tanks, retractable landing lights, 5 flares, radio, bank and turn, sensitive altimeter, rate of climb, clock, leather upholstery, new tires; finished in International orange and blue. Has been used for charter only. Always flown by competent pilots. Selling to get faster equipment. Price, $2,950. Vermilya-Huffman Co., Lunken Airport, Cincinnati, Ohio.

FOR SALE OR TRADE: 8A Stinson cabin; donut tires; full of instruments. Excellent condition. Consider late Lambert Monocoupe. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

STINSON RELIANT SR-5B: 350 hours; Smith propeller, flaps, 75-gallon tank; ship in splendid condition; delivered new in 1935. Leech Aircraft, Inc., Westchester Airport, Armonk Village, New York.

WARNER STINSON: 4-place. New covering. No time since top overhaul. $750. Ray A. Vawter, 25 Spencer Street, Hyattsville, Maryland.

STINSON S: Modernized Lycoming, 15 hours since topped and aircraft completely overhauled. Refinished high luster throughout, wings recovered, bonded, propeller reconditioned, etched. New battery, tires; relicensed; landing lights, flares. Spent nearly $1,000 reconditioning. Contemplated Continental tour. Absolutely everything checked, where worn replaced. Like new. $2,000. AERO DIGEST, Box 2373.

STINSON MODEL R: J-5; A-1 condition. Hamilton steel propeller, starter. $1,200 or lighter job. Gerald Francis, 15750 West Parkway, Detroit, Michigan. Phone: Redford 4630-R.

STINSON 1933 RELIANT: Deluxe. Ship and motor beautiful condition. Total time on ship, 550 hours; 150 hours since motor majored by Lycoming factory. Radio, night-flying equipped. Just relicensed. Priced to sell, $2,650. Tommy Metcalf, Transcontinental Airport, Toledo, Ohio.

STINSON SM8A: Lycoming motor. Ship, motor in excellent shape. Electric starter, full set instruments, landing lights, airwheels. Just relicensed. $1,575; will take smaller ship in trade. Robert G. Starrett, Sheldon, Iowa.

FOR SALE: Stinson SM8A: Landing lights, four flares, bank and turn, rate of climb, radio, licensed to July 1937; $1,600. James C. Rose, Commonwealth Flying Service, Elmhurst, Illinois.

STINSON R-3: $2,500, or first reasonable offer. Purchased from factory by present owner last December. Built for Mr. E. L. Cord. Retractable landing gear, adjustable landing lights, all blind instruments except Sperry; R C A radio; reclining seats; 37 hours total on ship. Lycoming factory-rebuilt 240 h.p. Lycoming, no time. This ship never cracked and like new. Fred Foote, Tribune Tower, Chicago, Illinois.

STINSON RELIANT SR-5B: 290 hours: landing lights, rate of climb, bank and turn, three 1½ minute flares, flaps, Smith propeller, radio, 75 gallon tanks, 20 hours since top overhaul. Leech Aircraft, Inc., Westchester Airport, Armonk Village, New York.

STINSON RELIANT SR-5: Serial No. 9574-A. Special paint, landing lights, flares. Daiber compass, turn and bank, rate of climb, radio, chronograph, wheel pants and generator. Total hours, 220. Excellent condition, fully equipped. Aircraft Service, Inc., Municipal Airport, Cleveland, Ohio.

STINSON JR. (SM7B): Wasp Jr. (300) powered. Ship and engine in A-1 shape. Licensed till June 1937. Starter, generator, landing and navigation lights; flares, bank and turn, rate of climb, air temperature, clock, radio, ring, pants, extra large fuel tanks, etc. Complete details and photograph on request. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

LATE MODEL SR-5 STINSON: Like new, powered with Wright E-type 250 h.p. motor. Everything on it. Priced to sell. Edw. A. Forner, Jackson, Michigan.

STINSON SM8A: In perfect condition. Actual time, 395 hours. Leather interior, new tires and battery. Will finance at $1,400 or make cash offer. Further details, write M. Meyers, 1241 Paddock Hills Avenue, Cincinnati, Ohio.

Swallow

SWALLOW TP: OX. New cover, motor good. DH wheels. Reasonable. Will take light car as part payment. Sam Flint, Holly, Colorado.

Travel Air

SPECIAL OX-5 TRAVEL AIR: Never cracked. Licensed to October. Extra fine condition. Want J-5 Travel Air. Prefer Speedwing. Jack Westfahl, Box 627, Ogallala, Nebraska.

TRAVEL AIR 12-W: 450 hours on ship; late type Warner motor, 150 hours. NACA cowl, starter, brakes, tail wheel, steel prop; red and gold; perfect condition; $1,350. Paul Pier, 927 S. Spring Ave., Sioux Falls, South Dakota.

SPORT TRAVEL AIR: 125 h.p. Kinner motor. Perfect condition. Heywood starter. 15 hours since major. Blind flying instruments and brakes. H. C. Whitney, Lake City, Florida.

OX-5 TRAVEL AIR: Excellent throughout. Ship time, 600 hours. New prop, motor; Millerized, Scintilla. Spare motor and Scintilla. Real cash bargain. E. C. Miles, 1031 South Travis Street, Sherman, Texas.

TRAVEL AIR 4000: Warner 125 h.p. Perfect condition, beautiful ship, excellent and economical performer; airwheels; licensed till February 1937; $925. Howard Webb, Airport Manager, Texarkana, Arkansas.

OX-5 TRAVEL AIR: Licensed May 1937. Bolted motor mount. 286 hours total, 25 since motor overhaul. Always hangared. Duals. First $395 takes it. Wilson Lumber Co., Vermontville, Michigan.

OX TRAVEL AIR: Good condition. Licensed till May 15, 1937. 25 hours since motor completely overhauled. This ship has been owned and operated by the same individual since built. A bargain at $500 cash. Moline Airport, Moline, Illinois.

TRAVEL AIR 4000: Latest outrigger undercarriage. Less motor; J6-7 mount; new factory wings, ailerons, covered, never cracked. Also licensed OX-5 Challenger. John B. Kratzer, Lewistown, Pennsylvania.

OX-5 TRAVEL AIR: Licensed. Ship, motor excellent condition. $525 cash. Would trade for Waco F and give difference. R. L. Clark, Route No. 2, Plymouth, Illinois.

J-5 TRAVEL AIR 4000: Absolutely like new; new covering; motor majored 70 hours ago. $1,000. OX-5 Travel Air, just licensed, $450; terms. Pioneer Aviation, Airport, Syracuse, New York.

TRAVEL AIR 6000-B: Cracked; needs one wing, motor mount and miscellaneous landing gear repairs. O. J. Whitney, Inc., North Beach Airport, Jackson Heights, N. Y. NEwtown 9-0300.

TRAVEL AIR 4000: Kinner, front exhaust. Motor perfect. Ship just relicensed. A real buy at $795. H. E. Oliver, 192 Brown Street, Pittsfield, Massachusetts.

J6-5 TRAVEL AIR: Clean. Just relicensed. Motor majored. Direct electric starter, turn and bank, rate of climb. Ship very clean; priced to sell. Stewart Lindberg, 901 Williams Street, Omaha, Nebraska.

Verville

FOR SALE: Verville 2-place biplane; Continental 165 A-70. Engine time, 163 hours; time on ship, 291 hours. Any cash offer considered. G. D. Sidway, P. O. Box 142, Sarasota, Florida.

VERVILLE CABIN: J6-7. 4PCLM. Instruments, starter, lights, flares, ring, semis; A-1. Best over $1,500 takes. Engines majored: J6-7, $445; Velie, $125. Airwheels and tailwheel, 29 x 13 x 5, $100. Merle Buck, 63d and Troy, Chicago, Illinois.

Waco

WACO 1934 DE LUXE CABIN: 225 Continental. Majored and modernized at factory. Lights, flares, radio, extra instruments. Trades and terms. Bennett Aircraft, Inc., Love Field, Dallas, Texas.

FOR SALE: J-5 Waco Straightwing seaplane. Licensed to July 1, 1937. Motor, ship, fabric and pontoons perfect. Bargain. Russell Neff, 380 University Avenue, St. Paul, Minnesota.

FOR SALE OR TRADE: Waco F. NC11259; 125 h.p. Warner. One of the last Waco F's built, Serial No. 3462; 330 hours total time on ship and motor. Ship redoped, hand rubbed finish. Engine completely majored four hours back. Ship recovered 1935. New plane condition throughout. Standard instruments, including air speed, compass; full air wheels, speed ring, military type windshields, navigation lights; fuselage vermilion red, wings silver. Just relicensed, never cracked. Will consider trades on 3-place open biplane powered with J-5, Jacobs or Continental, or cabin job. Fred J. Mohr, Fessenden, North Dakota.

WACO F-5: 225 h.p. Jacobs; radio, lights, flares, cockpit cover, generator, pants, polished vermilion wings and fuselage; exceptional performance. Also 210 h.p. Waco F-2. Paul Peterson, 2503 Union Avenue, Altoona, Pennsylvania.

WACO-J-5 ASO: Licensed December 1936. Equipped full airwheels, brakes, tailwheel, starter, dual controls. 30 hours since motor majored. Fabric like new. Will fly 500 miles for expenses. $1,250. Also Eaglerock fuselage, landing gear, cowling; OX-5 motor. Make offer. Gall Flying Service, Piney Fork, Ohio.

WACO 9: Perfect condition, covering like new. Just relicensed, $450. 180 Hisso Waco; Rubbed finish, brakes, landing lights, flares; condition like new; $850. Consider trades. Elwyn West, Route 3, Appleton, Wisconsin.

WACO NINE: New motor, Millerized. Scintilla, new Sensenich prop. Air speed, bank turn, duals. Covering excellent. Licensed. Best offer. Edward Seabold, 2415 W. North Avenue, Baltimore, Maryland.

WARNER WACO F: Starter, steel prop, majored, $1,500. Consider car, ship. Full and semi-airwheels, $35. Tires; Warner, Kinner, Wright J-5 motors and parts. J-5 steel prop, $85. Heywood starters, $60; parts. Want parts Fleet, Bird, Waco F ships' motors and other equipment. Swedler Aircraft Service, 816 Ontario, Toledo, Ohio.

WACO CUSTOM CABIN: Wonderful condition; many extras; must be seen to be appreciated. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

TANK WACO: Licensed August '37. Airspeed, compass, bank and pitch, booster; motor recently majored. Fine condition throughout. $600. S. E. Jackson, 725 Second, Portsmouth, Ohio.

WACO UIC: 1933. Continental 1934, 260 hours. Ship damaged. Cost $375 to fix. Sacrifice. $1,890. Must sell. Write G. H. Dusman, York, Pennsylvania.

BEAUTIFUL WHITE 1933 Waco cabin, with genuine leather upholstery and many extras. Real bargain for cash. Troy Flying Service, Troy, Ohio.

WACO ASO J-5 STRAIGHTWING: 25:00 on engine since completely major overhauled; no time on propeller since reconditioned by Ford factory; total time on airplane since new, 80:00; no time since completely recovered and finished; wings and fuselage Stearman vermilion, black stripe. New motor mount complete; new landing gear; brakes, wheels, tires and tubes; never cracked. Total time certified. Have pleasure of owning airplane which is practically new; price, $1,450. Waco A: Late 1933 Jacobs; no time since major; radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition; will consider trade. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO GXE: OX-5. Refinished like new, with extra OXX-6 motor. New 30 x 5 wheels and tires. Millerized. Just relicensed. Bargain at $575, or will trade on Taylor Cub. Springfield Aviation Co., Springfield, Illinois.

WACO 165 CONTINENTAL: Ship and motor excellent condition. Fabric and upholstery perfect. Steel prop, turn and bank, privately owned. Stockert Flying Service, South Bend, Indiana.

WACO F: Warner powered. Steel propeller, airwheels; $450 major on motor; recovered, relicensed May 1936; many extras. Terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

JACOBS STANDARD WACO Seaplane, on new Edo floats: Equipped with many extras, licensed on land or water. $6.500. Only 3 months old. AERO DIGEST, Box 2364.

WACO MODEL CUC: 285 Wright, controllable prop; radio, large 95-gallon gas tanks, all instruments. Privately owned. Time 120 hours. Cost $11,000; price, $6,600. AERO DIGEST, Box 2365.

WACO 1934 DE LUXE CABIN: 250 Wright. Ship and motor recently majored by Approved Repair Station. Radio, transmitter, lights, flares, pants, blind instruments, many other extras. Beautiful upholstery. One of the best in the country. Trades considered. Bennett Refining Company, 1209 Republic National Bank Building, Dallas, Texas.

WACO C CONTINENTAL: 1932. Formerly owned New York State Conservation Department. 100 hours since engine rebuild. Always had best care. Lights, flares; bonded, shielded, $2,500. Warren White, Albany Airport, Albany, New York.

FOR SALE: 1933 Waco cabin with Continental engine, which has just been overhauled and completely modernized by factory. Extra equipment: Landing lights, flares, bank and turn, wheel pants and steel propeller. Hand-rubbed finish in excellent condition. $3,300 at duPont Airport, Wilmington, Delaware.

WACO GXE: OX-5; recovered, flashy paint job; engine overhauled; duals. Licensed for one year; only $450. OX-5 Scintilla magneto; 26 x 11 x 6 Airwheels; Velie M-5 magnetos, carburetor, engine parts. Bob Gilfert, Schuylkill Airport, Orwigsburg, Pennsylvania.

WACO CABIN 1934: Jacobs motor; electric starter and generator; radio, lights and flares; extra instruments; leather upholstery; special hand-rubbed finish; wheel pants; 70-gallon gas tanks. Just relicensed. Priced to sell. Consider Waco F on trade. Tex LaGrone, Municipal Airport, Kansas City, Mo.

WACO TAPERWING J-5: Just relicensed. Has tank for inverted flying. Extra landing gear and Switlik parachute. Ship time 500 hours, motor time 350 hours. All for $1,100 cash. Jack Loesing, Hangar 3, Floyd Bennett Airport, Brooklyn, New York.

Miscellaneous Aircraft

Aeronca, Air King, American Eagle, Aristocrat, Arrow, Avro-Avian, Barling, Bellanca, Bird, Cessna, Command-Aire, Cub, Curtiss Robin, Curtiss-Wright, Driggs, Eaglerock, Fledgling, Fleet, Howard, International, Laird, Lambert, Lincoln Page, Lockheed, Moth, Pitcairn, Privateer, Rearwin, Ryan, Sikorsky, Stearman, Stepanich, Stinson, Swallow, Travel Air, Waco, Whittelsey.

J-5 EAGLEROCK: Licensed until July 1, 1937, $1,250. J-5 6-place Travel Air, very clean, $1,500. Steel prop. Night flying equipment on both ships; both in very good condition. Eaglerock just top overhauled. J. V. Kipp, Randolph, Minnesota.

FOR SALE: Aeronca C-3, Stinson R; both in perfect condition. Will consider trade for 1933 Stinson Reliant that is equipped for radio, or Kinner Fleet that is in flying condition. Merrimack Valley Airways, Airport, Manchester, New Hampshire.

SALE OR TRADE: Model "T" Stinson trimotor. Excellent condition; just relicensed. $2,500. B-5 Ryan, 60 hours since engine major, $1,000. Want: Reliant, Waco C, Fleet, or Waco F. Earl A. Field, 818 South Atlanta, Tulsa, Oklahoma.

FOR SALE OR TRADE: OX-5 Eaglerock, soon licensed; good OX, new propeller. $250, terms. Nearly new NB-8 Trainer, $875. Bill Obele, Fort Pierre, South Dakota.

145 WARNER MONOCOUPE: Total time, 215 hours. Painted steel dust grey with red trim. Electric starter, wheel pants, steel propeller, dual controls. Ship looks like new. For quick sale, $2,500. 125 Warner Fleet: 120 hours since major overhaul. Excellent plane for student instruction; $1,200. Complete stock of new and used Lycoming engine parts. Substantial saving on used parts. LeBlond 70 used parts. Sioux Skyways, Sioux Falls, South Dakota.

SALE OR EXCHANGE: 10 certified airplanes: J-5 Cessna cabin ship. J-5 Speedwing Travel Air. J-6 B-5 six-place Ryan cabin ship. J6-9 330 h.p. Travel Air Cabin ship, airwheels. One Type 2000 Travel Air OX-5. One OX-5 Laird. Two J6-9 Pitcairns, with or without motors, many extras. One OX-5 Waco 90. One J-5 B-1 Ryan 5-place cabin ship. One J6-9 Stinson, airwheels. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

STINSON R: Equipped blind flying, with hood, radio and night flying. Thirty hours since top; perfect condition, $2,295. Aeronca C-3: Just refinished and relicensed, $875. Warner-powered 4000 Travel Air: Bendix wheels and steel prop, $850. Will take trades or finance to reliable parties. Missouri Aviation Co., Airport, Springfield, Missouri.

GIPSY MOTH: Excellent, unlicensed, $650. Arrow Sport, Velie; perfect, $500. Monoprep oleo landing gear with wheels, $15. Eclipse 4-H-4 starter, $25. Used wheels, tires, tubes, $1.50. Scintilla switches, new, $1. Want: Motors, ships; pay cash. Kidd, Box 195, San Antonio, Texas.

WACO 10: Good shape, big wheels. Fabric perfect. Licensed. $435. International F-17; excellent shape; identified; Hartzell prop; $300 cash. Airport, Mt. Healthy, Ohio.

UNUSUAL BARGAINS: 1932 Cabin Waco, $2,000; 210 Continental, 150 hours since major; air starter, landing lights, flares, complete ambulance equipment, just relicensed. Waco F: $1,500. 125 Warner, 140 hours since major, air starter, air speed, compass, A-1 condition. Pitcairn Autogiro; 160 Kinner, 225 hours total time, air starter, complete sign towing equipment including 65 interchangeable 6-foot letters; ship like new. Jim Davis, Houston Airport, Houston, Texas.

REPOSSESSED TAYLOR CUB: A-40-3, 1935 model. 125 hours; $1,000, $200 down. Pitcairn Kinner B-5 autogiro, like new, $1,500; $400 down. Aeronca late 1935 de luxe, $1,200; $200 down. Travel Air J6-7 4-passenger monoplane, beautiful condition, $1,600; $700 down. Balance easy monthly payments. Also Lycoming and Cirrus Mark III English-built motor and Stinson Reliant and Avro Avian and Sikorsky S-38 parts. Cub and Continental motor parts. Motors and parts sold with no down payment. Aviation Finance Co., Hemlock, New York.

STINSON MODEL S: $1,775. Radio, blind and night equipment; pants, ring; engine modernized. Also 4-place Challenger Robin, $1,250, perfect condition. Dick Schall, Berwyn, Md.

OXX-6 WACO: Recovered and majored; 850 x 10 airwheels, special instruments; other extras, $600. American Eagle: Good condition, flying daily, motor excellent, $295. Dossett, 3315 Agnes Avenue, Kansas City, Missouri.

CURTISS-WRIGHT Air Sedan: Powered with J-6-7-E. Completely overhauled from propeller to tail wheel. Grimes Electric retractable lights; direct electric starter, generator. Wiley flares, radio; price, $2,750. Sikorsky S-39: Excellent condition; Grimes Electric retractable lights; parachute flares, radio; price $8,800. Ken-Royce; Challenger powered; excellent condition; price $975. Safair, Inc., Hangar B, Roosevelt Field, Mineola, New York.

WARNER PRIVATEER: Motor just majored; 500 hours total. Delivery August 10th. OX-5 American Eagle: Licensed; $350. Challenger Command-Aire: Motor majored. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

TRAVEL AIR 6000: 330 h.p. motor, majored; entire ship refinished; $2,350. Bellanca Pacemaker: Wright Model E, shielded for radio; perfect condition, $3,500. Hugh Watson, Sharonville, Ohio.

CURTISS-WRIGHT SEDAN: Refinished; Challenger majored, $1,300. Eaglerock M-2, newly covered, almost new OX-5, $450. Hisso Ryan, 3POLM, steel prop, $225. OX Air King, OX Lincoln Page, Velie Coupe. G. O. Imm, Fergus Falls, Minnesota.

CIRRUS POWERED RACER: Speed better than 200 m.p.h., $800. Menasco powered Howard racer, speed over 200 m.p.h., $1,200. J-5 4000 Travel Air, equipped for sky-writing, $1,175. Harold Neumann, 3000 Tracy, Kansas City, Missouri.

DRIGGS: Rover powered, engine completely majored, fuselage recovered, extra instruments, $975. Aeronca C-3, engine majored, oleo landing gear, enclosure, $900. Aeronca C-3, late 1935, like new, $1,350. 1934 Monocoupe, 145 Warner, like new, $2,400. Warner Waco F, $1,495. J-6 Aristocrat, excellent condition, $1,100. Air Activities Airport, West Chicago, Illinois.

STEPANICH CENTER WING: Salmson 40 h.p., single seater. Span 28 feet. Top speed, 130 m.p.h. Test flown only. For sale or trade. A. Stepanich, 27-147th Drive, Rosedale, L. I., N. Y.

FOR SALE: Jacobs Cabin Waco; Jacobs Waco F-5; Warner 125 Monocoupe; Warner 145 Monocoupe; Stinson SM8A; Stinson 1934 Reliant; Lambert Monocoupe demonstrator; Bellanca Skyrocket; Lockheed Air Express, Lockheed Vega; Taylor Cub; J6-7 Travel Air; J6-5 Straightwing Waco. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

1935 CONTINENTAL closed Cub, $950. 1935 Cub, $850. Aeromarine Cub, $995. Velie Monoprep, $395. Taylor Aircraft Company, Bradford, Pennsylvania.

WACO CABIN: 210 Continental; 50 hours since major. Starter, electric flares, landing lights, instruments. Immediate delivery on wheels or floats. Stearman, Wasp Jr.: Instruments, radio. Also Hisso Eaglerock; Avro-Avian; American Moth; Travel Air 4-place cabin, others. Motors and parts. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

BIRD: 4-place, late type; Kinner B-5; good condition, extras; equipped float fittings; $1,250. Also Aeronca C-3 with E-113-A motor; sell reasonable. S. Reich, Roosevelt Field, Garden City, New York.

SHIPS FOR SALE: Aeronca, '35 model, $1,300. OX-5 Eaglerock, completely rebuilt, licensed, $495. Velie Monocoupe, refinished and licensed, $475. Velie Monocoupe, slightly cracked, $350. OX-5 Swallow; can be licensed with some work, $325. Lake Region Flying Service, Devils Lake, North Dakota.

STINSON JR.: J-5. Very good shape; less than 500 hours on ship and motor. Absolutely must be sold this month. Taylor Cub: 1934. Only 6 hours on new motor; ship just refinished and in perfect shape; never been cracked. Whittelsey Avian: 1930. Cirrus Mark III. Full airwheels, wing slots, ship just refinished. Will accept trade, ship or car. Write or wire H. B. Kaywood, General Delivery, Marshall, Michigan.

OX WACO: Fair condition, $325. Avian, Cirrus powered, airwheels, licensed, $350. Kinner Bird, new airwheels and prop, excellent covering, $1,025. American Eaglet, relicensed, good condition throughout, $400. Waco F, 125 Kinner, new prop, brakes perfect, $1,500. Taylor Cub, 1936, a buy. Meinke-Eldred Flying Service, Willoughby, Ohio.

FLEDGLING: Challenger 185. Good condition; licensed until May 1937. $850. OX Eaglerock, Scintilla mag, Miller overhead, extra motor. Davis Aircraft Salvage Co., 112 Bay Avenue, Springfield, L. I., N. Y.

STINSON U TRIMOTOR: Perfect condition, $3,800. Rearwin Sportster, 1935 model, little time, $1,600. Waco Taperwing J-5, beautiful ship, lots extras, $1,800. Waco Cabin, 1934, good condition, $2.800. Taylor Cub, demonstrator, 40 hours, $1300. Fleet Trainer Kinner, $1.400. Kinner, front exhaust, $375. Menasco Pirate, slightly damaged, with propeller; steal at $350. DePonti Aviation Co., Wold-Chamberlain Airport, Minneapolis, Minnesota.

STINSON S: Equipped radio, blind flying instruments, night equipment. Just relicensed; motor just majored by approved shop. Beautiful finish. $1,800. Trimotored Stinson T, completely equipped; plane and motors in excellent condition; $1,875. Two new model Taylor Cubs; one three months old, $1,200; one three weeks old, $1,290. Licensed OX American Eagle, excellent condition, $300. Wright-Hinkle, Bernard Airport, Youngstown, Ohio.

WACO 10; CHALLENGER KR-31: Both ships completely recovered and licensed until 1937. Very little flying time on either. Price, $400 for either one. G. Rudolph, 2919 South 13th Street, Philadelphia, Pa.

LOENING COMMUTER: 285 hours total; $2,500. Ship in excellent shape. Aeronca seaplane, motor majored and ship completely recovered, $1,600. Monocoupe 145-D, in excellent shape, $2,500. Aircraft Brokerage, North Beach Airport, Long Island, N. Y.

CLOSING DATE

for

CLASSIFIED ADS

SEPTEMBER ISSUE—

AUGUST 18th

Copy received after

that date will be held for

October publication

ENGINES

Anzani, Caminez, Cirrus, Curtiss, Hisso, Isotta Fraschini, Pratt & Whitney, Siemens-Halske, Wright.

ONE CONVERTED B WASP: No. 822 to C type; for sale, $350 as is. Has .020 pistons forged, 300 hours since majored. Still going strong. General Tire & Rubber Company, Akron, Ohio.

FOR SALE: Curtiss "Crusader" 125 h.p. six-cylinder, inverted, air-cooled, in-line engine. Complete with hand cranking Eclipse starter and wood propeller hub. First class condition. $150. Argonaut Aircraft, Inc., Tonawanda, New York.

J6-9-D WRIGHT ENGINE: Completely majored in our shop. $1,250. Air Associates, 5300 West 63d Street, Chicago, Illinois.

HISSO 180 E: In excellent condition, $35. Hisso motor mount and complete cowling, like new, for Travel Air, $30. Will trade above for J-5 motor or parts. Missouri Aviation Co., Airport, Springfield, Missouri.

GOVERNMENT OVERHAULED 90 h.p. OX-5, $127.50. New 110 h.p. Anzani, $99. Overhauled 55 h.p. Velie M-5, $168. Used 55 h.p. Siemens-Halske, $148.50. Overhauled 35 h.p. Anzani, $195. Used 135 h.p. Caminez, $95. Karl Ort, 581 Poplar St., York, Pennsylvania.

ENGLISH CIRRUS: Mark III, Upright. 95 h.p. Complete in original crate with tools. Never used. $275. N. W. Perdew, Hasbrouck Heights, N. J.

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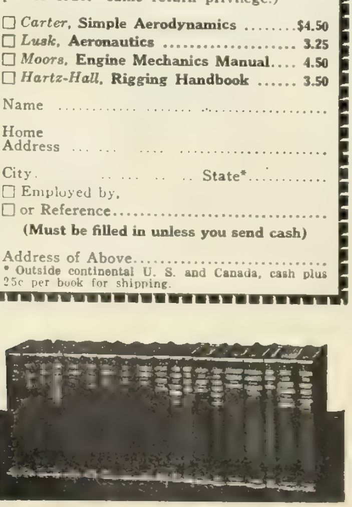

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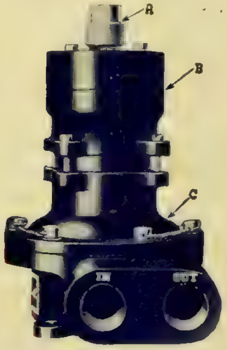

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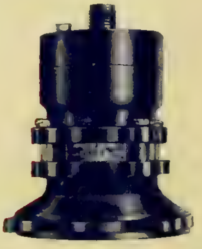

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Volume 29 *Number 3*

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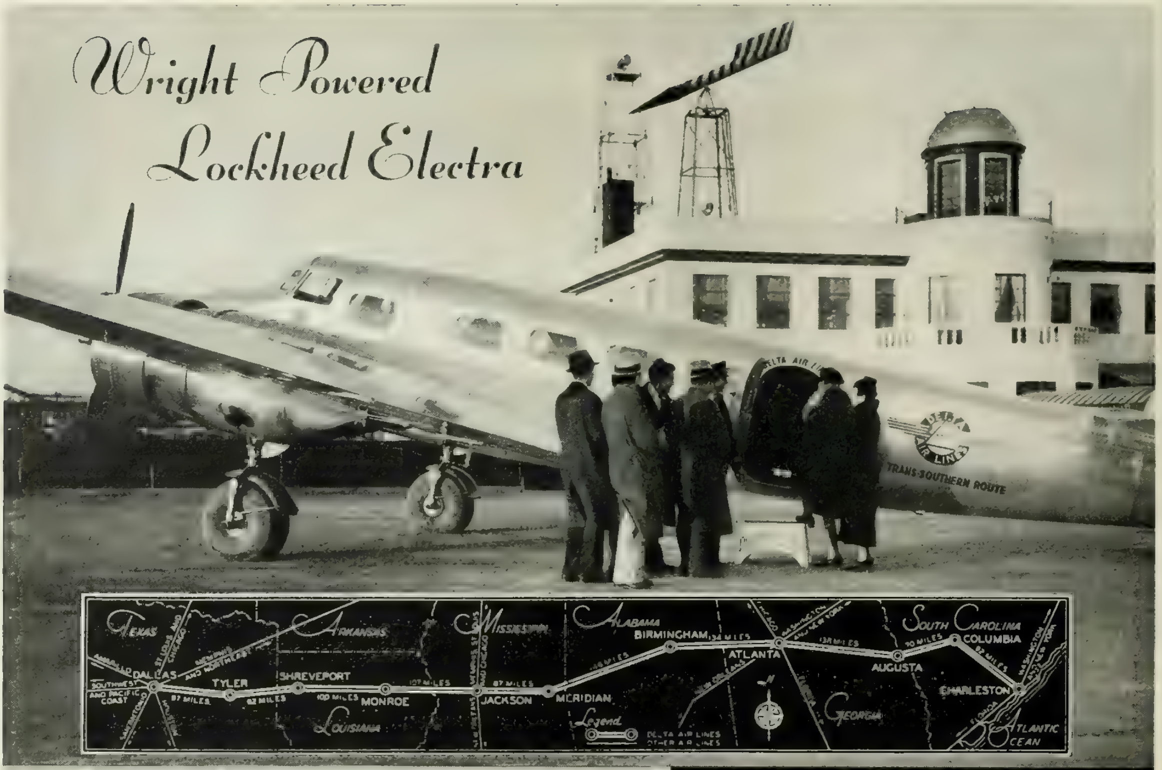

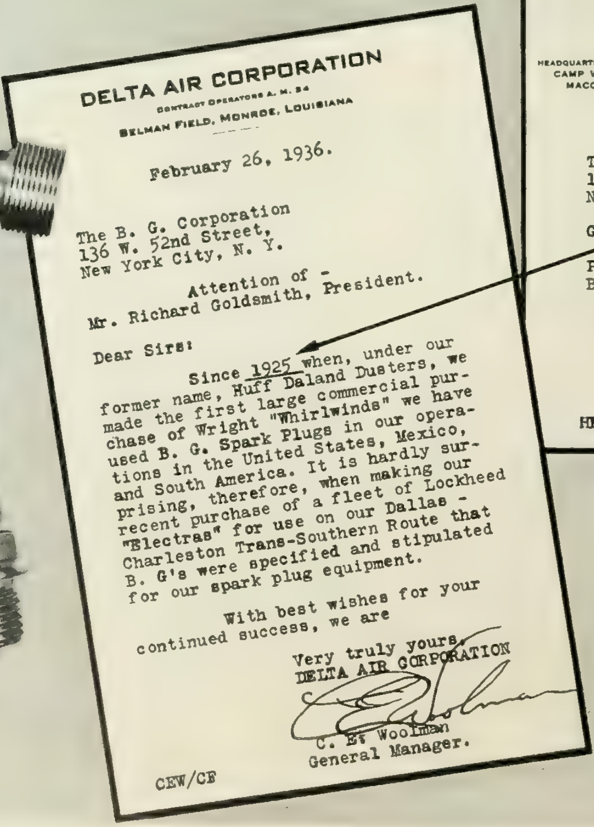

DELTA AIR CORPORATION
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SELMAN FIELD, MONROE, LOUISIANA

February 26, 1936.

The B. G. Corporation
136 W. 52nd Street,
New York City, N. Y.

Attention of -
Mr. Richard Goldsmith, President.

Dear Sirs:

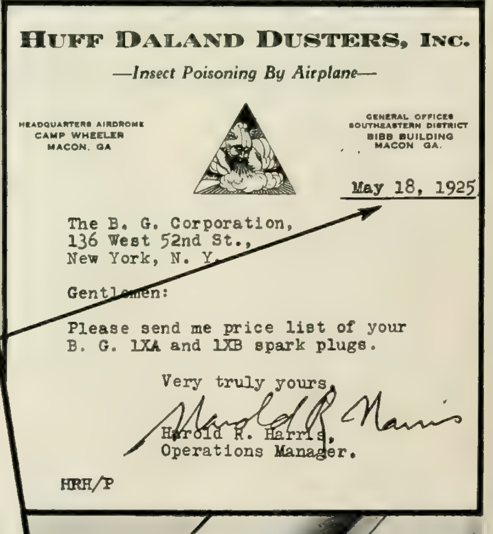
Since 1925 when, under our former name, Huff Daland Dusters, we made the first large commercial purchase of Wright "Whirlwinds" we have used B. G. Spark Plugs in our operations in the United States, Mexico, and South America. It is hardly surprising, therefore, when making our recent purchase of a fleet of Lockheed "Electras" for use on our Dallas - Charleston Trans-Southern Route that B. G's were specified and stipulated for our spark plug equipment.

With best wishes for your continued success, we are

Very truly yours,
DELTA AIR CORPORATION

C. E. Woolman
General Manager.

CEW/CF



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—*Insect Poisoning By Airplane*—

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MACON, GA

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SOUTHEASTERN DISTRICT
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MACON GA.

May 18, 1925

The B. G. Corporation,
136 West 52nd St.,
New York, N. Y.

Gentlemen:

Please send me price list of your B. G. 1XA and 1XB spark plugs.

Very truly yours,
Harold R. Harris
Harold R. Harris,
Operations Manager.

HRH/P

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The Birdmen's Perch

Among other things, I'm editor of the screwiest page written. And like all editors, I'm nosey and snooping for news. So sharpen an old valve stem, dip it in Gulfpride that's been used for about 500 hours (under that, it's too clean)—and send some spare parts from your gossip bin. High tension lies are just as good as true stories—but they gotta be good.

Editor—AL WILLIAMS, (alias Tattered Wing Tips).
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

FARMER TAKES A RIDE

"A captain in the French army is said to be the first man ever to have made a sustained flight in his own glider.

"The machine weighed 90 pounds and looked like an albatross. One day he placed the contraption on a farmer's cart, then had the farmer whip up his horse to a fast trot.

"When the horse got going, the captain lifted the front edges of the wings and the albatross sailed upward. Unfortunately, the mooring rope whipped around the farmer's waist and hoisted him skyward with the glider.

"The fellow howled so loud that the officer took pity, sailed close to the ground and let him drop, intending to soar away into the clouds.

"But, minus its ballast, the albatross didn't navigate so well, so the daring Frenchman brought her to earth and called it a day. At least, that's *his* story." —H.H.

RAISED EYEBROW DEPT.

"Do they put lead in Gulf Aviation Gas to weigh it down? If so, please put more lead in the next batch. This gas still makes my plane go too fast."—J.D.

PIGEONS BEAT PLANES

"Until some one invents a plane which will land in a city editor's lap, pigeons will be one up on planes for short hauls.

"A New York paper uses the birds to hustle negatives from metropolitan football games to the newspaper office. About ten minutes after the picture is snapped, the negative is in the dark room."—H.B.

SCARED-Y CAT!

"I have a friend who makes a living as a stunt pilot. The other day I took my young nephew out to see him.

"After performing his quota of barrel-rolls, loops and spins, he landed and took the youngster around the fair grounds.

"When the kid tried to get the pilot to accompany him on a roller coaster, my friend replied, 'Get me on one of those things? I should say not! Why I wouldn't trust my life on them.'" —T.Z.

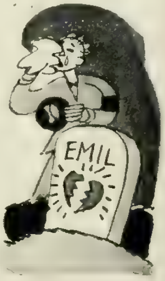
THIS MONTH'S WHOPPER

"I raise whippets. You know, those racing dogs that chase an electric rabbit down the track, first dog in wins.

"Well, sir, I had a dog I called Emil. This dog was so slow it made you tired to look at him. That is, he *was* slow until one day I rubbed him down with some Gulfpride Oil instead of his usual dog liniment. From then on that dog changed. Gosh, he started to beat the rabbits in.

"And I started cleaning up. Emil got so's he'd sleep till the door of his box clicked open; yawn a couple of times; stretch himself; give me a wink and . . . *whiz-z-z* —he'd pass the rabbit like a shot and we'd have another race in our pockets.

"Then one day we had the tough luck to run on a track operated by an aviator who knew all about Emil and Gulfpride. That guy—now get this—soaked his *electric rabbit* in Gulfpride! Gee, it makes me sore and it makes me sad to think of what happened.



"That gol-dern hopper beat my Emil in. When my poor dog realized the rabbit had come in first, he just went to pieces. Ten minutes later he died of a broken heart.

"I blame it all on that aviator and your danged Gulfpride Oil. So, I'm warning you—I'm packing a gun." —A.J.S.

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"GO TO PARKS" is Aviation's Advice to YOU

This new bi-motor with retractable landing gear, wing flaps, two-way radio installation, and complete blind flight equipment, is to be delivered to Parks Air College. It will be placed on the "line" for the use of advanced professional flight students. Of the type now accepted as standard for land planes on air transport lines throughout the World, this bi-motor, the "Monocoach", gives the Parks professional flight student the advantage of thoroughly modern flight equipment.

You want to enter aviation. The type of training you secure will have an important bearing upon your career in this great industry that "in a few years has revolutionized the habits of the world". It can mean all the difference between just a job and the glorious achievement you desire.

You will do well to select a school which has earned the favorable recognition of the entire industry. Then, when you graduate, the prestige of the school will be yours, too. Here are a few facts that will help you in your consideration of Parks Air College.

A correspondent,* in making his application for admission to Parks Air College, wrote:

> "Both my friend and I contemplated attending another school, but, as you know, I first investigated Parks, and the result is, both of us are on our way there."

Then he added this significant statement:

> "I made a trip to Miami yesterday to talk to the Pan American and Eastern Airlines people, and their advice was, 'Go to Parks'."

ONLY PARKS GRADUATES WANTED

So many Parks graduates are found at the principal maintenance base of another major airline* that a visitor remarked: "It looks here like a reunion of Parks graduates". An order, effective throughout the extensive system of this airline, directs that all new personnel for the maintenance division shall be selected from among Parks graduates if any are available. Since Parks Air College is independant, being unrelated financially to any other organization, such an order can result only from recognition of the superior merit of Parks training and Parks graduates.

PARKS PROFESSIONAL FLIGHT GRADUATE RECEIVES COPILOT APPOINTMENT

This wire from J. D. MacGregor, Operations Manager of Pan American Grace Airways, requires no comment except to say that Mr. MacGregor follows a rigid policy of selecting only the highest type of new flight personnel:

> "YOUR WIRE JUNE SEVENTEENTH HAVE OPENING FOR COPILOT SUGGEST FRANK WHITTAKER (not his name*) COME HERE OUR EXPENSE IMMEDIATELY FOR INTERVIEW AND BE PREPARED DEPART FOR SOUTH AMERICA FRIDAY IF HIS APPLICATION ACCEPTED."

Two days later Whittaker, an executive Transport Pilot graduate of Parks Air College, wired:

> "SAILING FRIDAY FOR CRISTOBAL FLYING FROM THERE TO LIMA."

(This was the second Executive Transport Pilot graduate Mr. MacGregor secured from Parks this year for a position as copilot.)

THE TRAINING DIVISION OF COMMERCIAL AVIATION

Instances could be multiplied showing that Parks Air College is recognized by both aircraft manufacturers and airline operators as the "training division of commercial aviation".

Parks graduates are with every major airline and aircraft factory in the United States. They are serving as chief pilots, pilots, copilots, flight engineers, meterologists, in maintenance, radio, sales, field operations, and the various branches of production, including aircraft factory production manager.

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If you want to enter aviation, if you are genuinely in earnest in your desire to make a career for yourself in this new industry, if you are willing and anxious to devote all of your energy to your preparation, then Parks Air College will welcome you.

You are invited to send for the catalog. It gives complete information about facilities and courses.

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Your copy will be mailed you promptly.

Fall Term, September 28. *Winter Term, January 4.*

*Name on request

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Read what a few of them say:

ARTHUR M. MEYERS, Master Airplane and Engine Mechanics Graduate: "Immediately upon the completion of my course at Roosevelt Aviation School, I successfully passed my tests before the Bureau of Air Commerce for my airplane and engine mechanics licenses. As the result of my thorough training at the School, and with the help of your placement service, I secured a position with the Aviation Division of the Gulf Oil Company. I am now first assistant to the Superintendent of Maintenance, Mr. Frank Tye."

PETER HANSEN, Limited Commercial and Elementary Airplane and Engine Mechanics Graduate: "About four years ago I completed my training at Roosevelt Aviation School. Ever since that time I have been steadily employed. Now I am connected as a partner with Foley & Company, general airplane repair and overhaul work. This indicates that my training was thorough. I know that it was worth a good deal more to me than it cost. I heartily recommend Roosevelt Aviation School as an outstanding institution."

AUGUST KOWAL, Master Airplane and Engine Mechanics Graduate: "I completed my training at Roosevelt Aviation School two years ago and have been steadily employed by the General Sheet Metal Company on airplane work ever since. I appreciate the help the School gave me throughout my training and also its interest in assisting me to get this position. The personal interest the Instructors took in me will long be remembered. Certainly Roosevelt is the School to choose if one is interested in aviation."

LOUIS LANGHAUSER, Master Airplane and Engine Mechanics Graduate: "I had no trouble whatever in standing my tests before the Bureau of Air Commerce when I applied for my airplane and engine mechanics licenses. Immediately thereafter I secured a position with Aero Trades where I specialize in sheet metal work and welding. My experience convinces me that no School has better Instructors and that none can do more for the student who is in earnest and wants to get somewhere in the aviation industry."

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A. D. September, 1936

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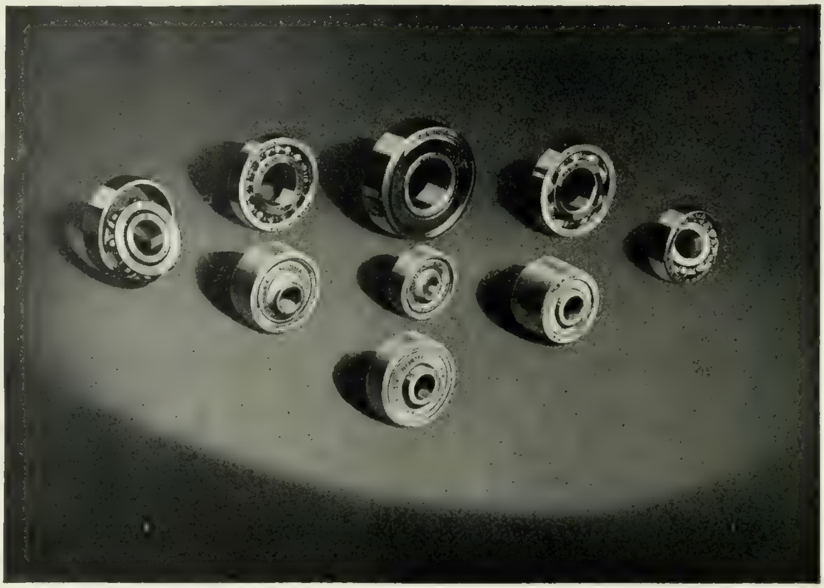

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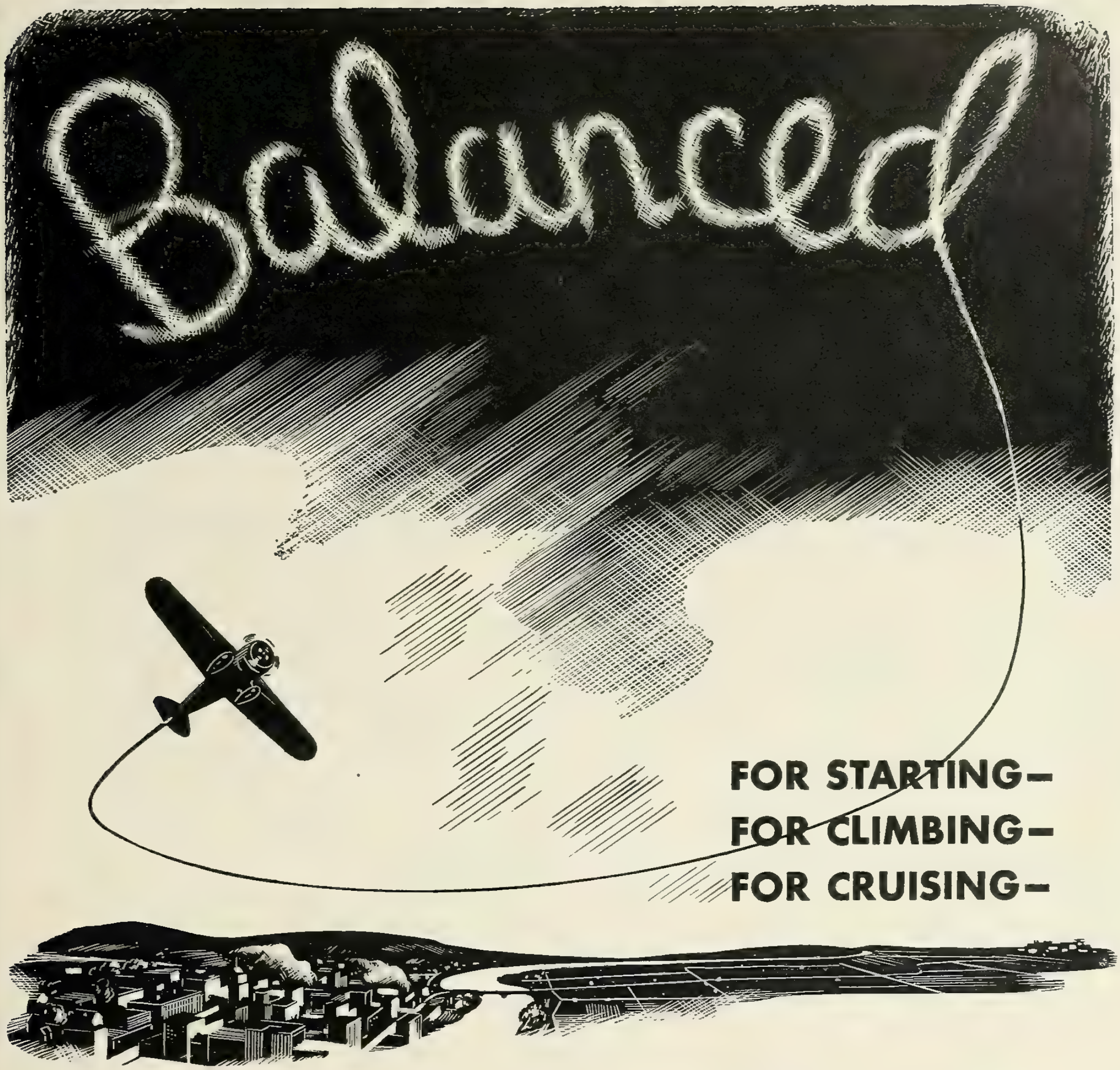

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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone PLaza 3-6969. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5.

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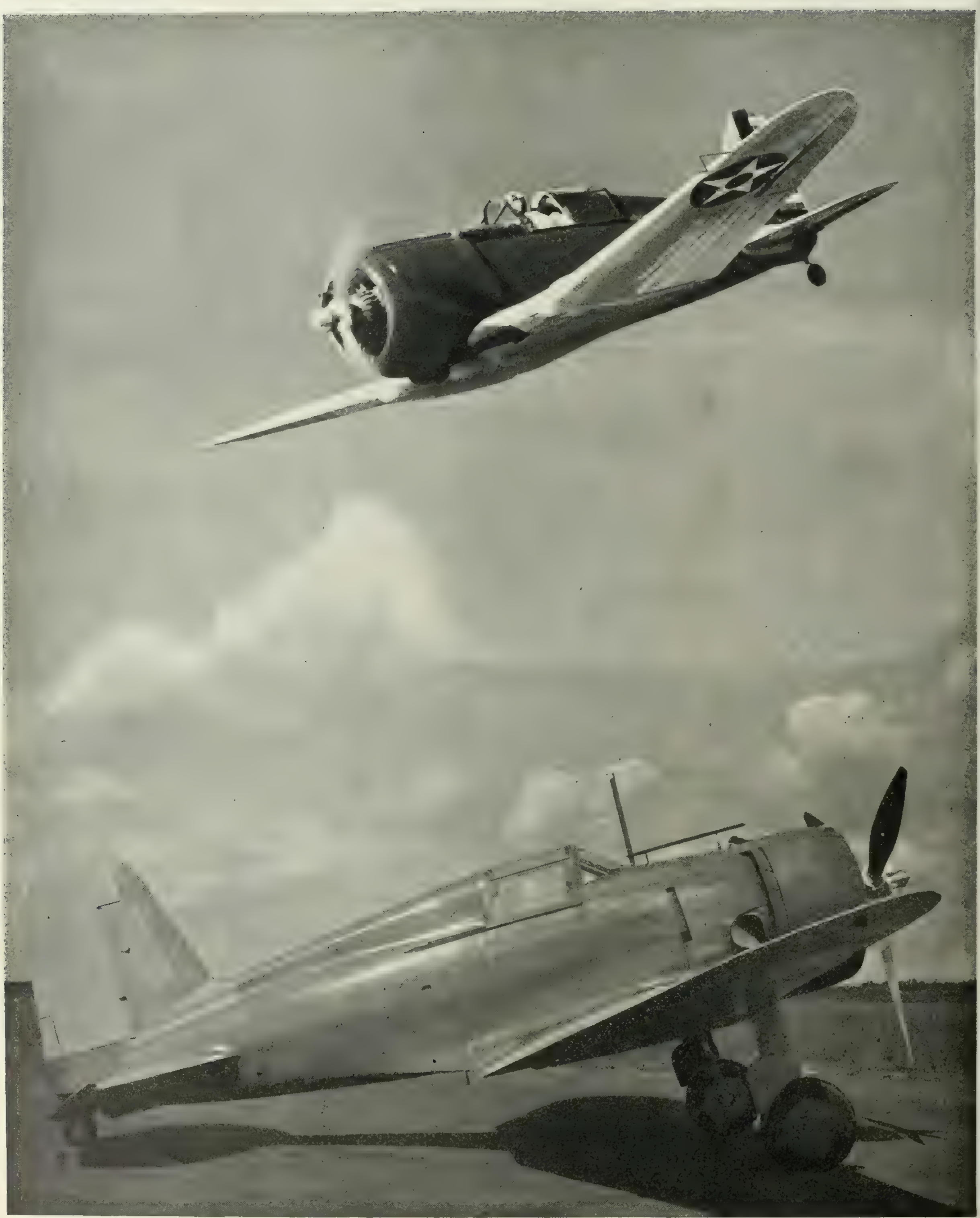


The Vought Model V-143 Monoplane Fighter powered by the fourteen-cylinder 750 horsepower Pratt & Whitney Twin Wasp Junior engine

1936 NATIONAL AIR RACE PROGRAM

●

● Competition in this year's National Air Races is expected to be keener than at any other race in the past, record entries already having been received in many of the major events which will be run off at the Los Angeles Municipal Airport, Sept. 4-7, inclusive.

At least seven, and possibly nine, planes will take off from Floyd Bennett Field, New York, for Los Angeles, Sept. 4 in the Bendix Transcontinental Derby which marks the opening of the 1936 races, the 16th annual classic of the industry. Thirty-two entries have already been received in the Ruth Chatterton Sportsman Pilots Race which started at Cleveland August 29 and is also scheduled to arrive in Los Angeles during the opening day of the show. Nineteen pilots have been entered in the Thompson Trophy Race, a record entry for the event.

Foreign participation in the past has been limited to some of Europe's best stunt fliers. This year, however, the four-day program, with $70,000 prize money at stake, will witness various foreign pilots and planes in a number of events at the races, including the Thompson, Shell and Greve Trophy races, as well as the Chatterton Derby.

With the support of the French Ministry, France is sending Michel Detroyat with two *Caudron-Renault* racers, three engines and two mechanics to represent the Aero Club of France. Detroyat will be a contender in the Thompson race. Germany's Gerd Achgelis is returning this year to continue his repertoire of stunt flying, while Miss Peggie Salaman is representing England in the Chatterton event.

Both the Bendix and the Thompson races this year are expected to bring about a number of surprises. For the first time in the Bendix, women will compete with the men for the total purse of $12,500, of which $2,500 will be awarded to the pilot who establishes a new transcontinental speed record. Amelia Earhart, Laura Ingalls, Louise Thaden and Jacqueline Cochran have already been entered and are grooming new and faster equipment than they have been flying in the past. In addition, several newcomers to the Bendix are expected at Floyd Bennett Field for the take-off, one of them being the experienced west coast pilot, Harry Crosby, who has built a new low-wing racer around the supercharged *Buccaneer* Menasco engine. Also entered in the Bendix are Roscoe Turner, Benny Howard, S. J. Wittman, Joe Jacobson and George Haldeman, who will fly the Bellanca racer built for the MacRobertson race from England to Australia.

The Thompson trophy race this year, which carries a total purse of $20,000, will be flown over a 10-mile course, 15 laps for a distance of 150 miles. Qualifying speed is 225 mph. Of the total purse, $2,500 will be awarded to the winner in addition to the regular prize money, provided his speed exceeds the present National Air Race record of 252.686 mph. Entered in this event, the climax of the air races, are Turner, Haldeman, Wittman, Detroyat, Crosby, Jacobson, Harold Neumann and Earl Ortman. Turner is expected to fly his new plane which is built around a twin-row P & W Wasp engine.

The Louis W. Greve trophy race represents a total purse of $10,000 and is open to planes with engines of 550 cu. in. displacement, or less. The Shell Oil Co. has sponsored three races with a total prize purse of $12,000. The Shell Trophy race is a 375 cu. in. event with a purse of $6,000; the Shell Award and the Shell Cup races are also for planes with engines of 375 cu. in. displacement and each has a total purse of $3,000.

Opening day ceremonies will begin at 1:30 p.m. with the arrival of the Chatterton pilots from San Diego on the last lap of their trip from Cleveland. Following this will be parachute jumping contests; an extensive demonstration of planes from the early machines; a demonstration of "crazy" flying; closed course races; a bat-wing jump; acrobatic exhibitions by Achgelis and Milo Burcham and by the Men on the Flying Trapeze; demonstrations and maneuvers by the Army, Navy and Marine Corps; Hollywood stunt fliers; stunting exhibition with a tri-motored Ford; and a 12,000-ft. power dive.

Recognition of the pioneers of flight will be given during the races when members of the *Early Birds* from all sections of the country will be guests of air race officials on the opening day which has been dedicated to these men and women. On Saturday, there is to be a reunion at the Hotel Clark, official headquarters for the group and where General Manager P. G. B. (Bud) Morriss maintains a room for permanent headquarters.

The Junior Chamber of Commerce at Los Angeles is sponsoring the air race meet this year and will stage an elaborate 30-mile parade from downtown Los Angeles to the airport with cities throughout Southern California participating.

As before, Clifford and Phil Henderson are dividing the duties of the race management.

The tentative daily line-up of events and prize money follows:

Friday, September 4

Bendix Trophy Race, transcontinental free-for-all speed dash; $2500 to be awarded to pilot who breaks transcontinental speed record................	$12,500
Ruth Chatterton Trophy Race, men and women sportsmen pilots; race ends at Los Angeles.	5,000
Parachute Jumping Contest.....	200

Saturday, September 5

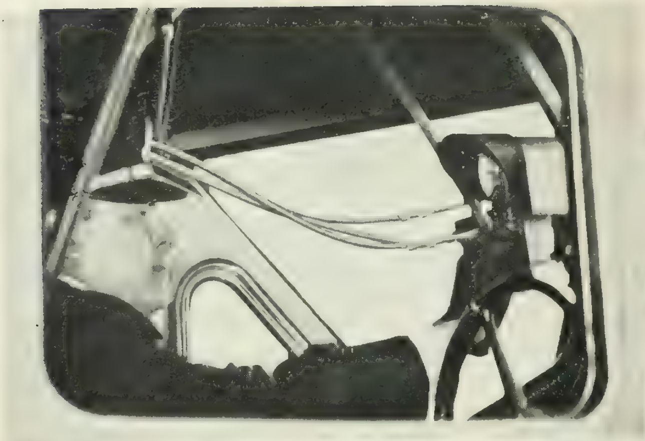
266-cu.in. displacement; free-for-all, men only; 15 miles, 3 laps over a 5-mile course; qualifying speed, 115 mph...........	1,200
ATC handicap; Amelia Earhart Trophy, women only; 25 miles, 5 laps over a 5-mile course; qualifying speed 100 mph.....	1,500
375-cu.in. displacement; free-for-all, men only; Shell Trophy Race; 100 miles, 20 laps over a 5-mile course; qualifying speed 175 mph	6,000
Parachute Jumping Contest.....	200

Sunday, September 6

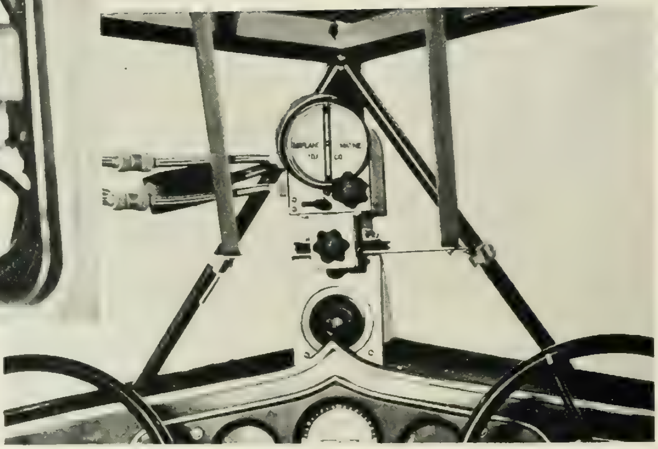
266-cu.in. displacement; free-for-all, men only; 15 miles, 3 laps over a 5-mile course; qualifying speed, 115 mph..........	1,200
375-cu.in. displacement; free-for-all, men only; Shell Award; 50 miles, 10 laps over a 5-mile course; qualifying speed 175 mph	3,000
550-cu.in. displacement; free-for-all, men only; Louis W. Greve Trophy Race; 100 miles, 20 laps over a 5-mile course; qualifying speed 200 mph.........	10,000
Parachute Jumping Contest.....	200

Monday, September 7

800-cu.in. displacement; ATC race, men only; 25 miles, 5 laps over a 5-mile course (final event of C-license contest)....	1,000
550-cu.in. displacement; free-for-all, men only; Shell Cup; 50 miles, 10 laps over a 5-mile course; qualifying speed 200 mph	3,000
Unlimited, free-for-all; Thompson Trophy; 150 miles, 15 laps over a 10-mile course; qualifying speed 225 mph...........	20,000
Parachute Jumping Contest.....	200



All photos by Rudy Arnold



Tests of a Cathode Ray Direction Finder

C. T. SOLT

Chief Radio Electrician
Communications Div., U. S. Coast Guard

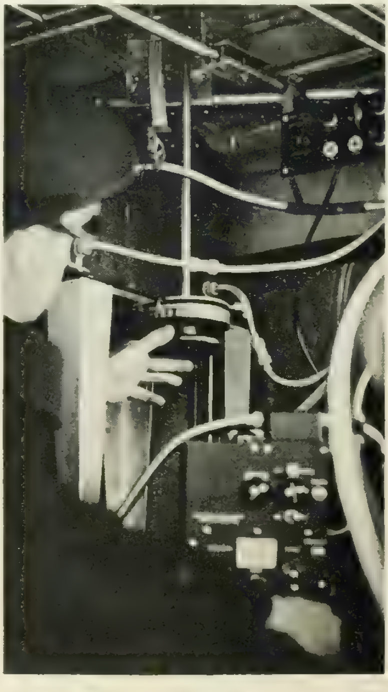
Installation of the Cathode Ray direction finder in the Coast Guard's Stinson Reliant

● Encouraging results have been obtained by the U. S. Coast Guard during recent tests it conducted of a cathode ray radio visual direction finder which was submitted for testing by Airplane and Marine Direction Finder Corp., whose chief engineer, Edward Hefele, is responsible for the design.

These tests were inaugurated December 1935 and mark perhaps the first successful use of aircraft radio direction finding equipment of the cathode ray type. While the cathode ray has been utilized for several years in various forms in conjunction with ground station direction finding, the applications described incorporate original efforts and ideas.

Tests included more than 150 hours of actual flying (40 during the hours of darkness) over mountainous, flat and rolling country, as well as over bodies of water, and along coast lines of various configurations. Tests were supervised by the author, and were conducted in the Coast Guard's Radio Test Stinson plane, with Coast Guard pilots J. R. Orndorff and W. N. Durham cooperating.

Possessing features which the Coast Guard is investigating to determine their ultimate merit for radio navigation of aircraft in conducting the duties incident to the saving of life and property, the performance of this instrument during tests indicated that reliable bearings could be consistently obtained, through heavy intermittent atmospheric electrical disturbances, as well as interference from other radio signals on the same frequency as the observed signal. Performance was particularly impressive during night flying, and while so-called "night effect" was frequently noted, directional accuracy of observed bearings apparently was not affected. This was frequently checked during flight over mountainous country.



Taking relative radio bearings in the cabin

The equipment, in the author's opinion, possesses the desirable features of a serviceable aural-null direction finder combined with those of a reliable visual indicator. Its action is such that upon approaching a station being used for radio guidance, the ray pattern on the instrument "screen" gradually changes its form from a vertical line beam into an ellipse, until finally, when directly over the station, a circle is seen, or the elliptical pattern goes completely off the face of the instrument, thereby giving a definite indication of the position of the airplane over the transmitting station. The directional sense characteristic is entirely automatic, and the approach and departure of the aircraft, with regard to any broadcasting or radio range station being employed for guidance, is at all times definitely indicated. The sensing of the equipment in the Coast Guard laboratory plane is arranged so that when utilizing the device for homing purposes and approaching a station, the vertical beam inclines to the left, thereby indicating that the plane is swinging to the right of the observed station's line of bearing. With this arrangement, if the beam inclines to the right of the vertical guide lines on the cathode screen, it is an indication that the observed station bears to the left of the course being flown.

Indication of line of bearing and directional sense were found to be satisfactory with A-1, A-2 and A-3 classes of radio signals. Telegraphic signals are readable by the cathode pattern, which is responsive to keyed telegraphic signals of any speed. In addition to functioning as a radio direction finder, homing device, right-and-left indicator and nondirectional receiver, this system gives accurate line of bearing and directional indication of electrical storms.

An advantage of this equipment is its ability to give accurate bearings on signals having comparatively low strengths (less than 50 microvolts per meter) through intermittent electrical disturbances having field strengths on the order of 2 to 3 volts per meter. It was found that accurate radio bearings could be obtained on any given signal having a field intensity on the order of 10 microvolts per meter through intermittent interfering telegraphic signals on the same frequency, regardless of the field intensity of the interfering signal. It was further noted that any signal normally encountered in aircraft radio guidance (regardless of field intensity) tuned to within a few kilocycles of any observed signal within the frequency range of the equipment will not cause any error in line of bearing indication. While visually indicating the telegraphic significance of keyed radio signals, such indication causes no angular movement of the line of observed bearing.

Directional indication obtained and the accuracy of the radio bearings is neither dependent on parallel balanced nor bridge circuits or delicate phasing, or both. The receiver employs two separate amplifying channels, one utilizing the energy from a simple vertical antenna and the other amplifying the radio frequency signal picked up by a rotatable loop antenna. The visual indication obtained with the cathode ray projector is a resultant of the vertical and loop antenna signals. Consequently, directional accuracy can only be destroyed by serious derangement of the rotatable loop. If the vertical antenna is disconnected, satisfactory visual and aural indications are still obtainable by use of the rotatable loop, as this equipment operates as a null type direction finder.

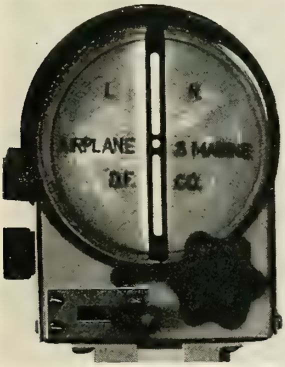


Fig. 1. "On course" for homing and null indication when obtaining radio bearing

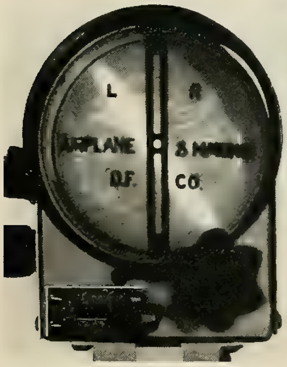


Fig. 2. Station to left of course or indicator pointer to left of null

During tests it was found that a consistently satisfactory distance range of 125 to 200 miles could be obtained on the better type of broadcasting station, regardless of atmospheric conditions. It is expected, however, that this range will be greatly extended as further experiments are conducted and also in an improved model which will be tested by the Coast Guard in the near future.

Figures 1 to 5 inclusive show typical patterns obtained with the Kaess cathode ray direction finder. Figure 1 is the "on course" indication usually obtained, while figures 2 and 3 show deviation to the right and left of the course or rotation of the loop through the null if the equipment is used as a radio direction finder. Figure 4 shows the elliptical pattern, which indicates that the station being used for radio guidance is being rapidly approached, and figure 5 indicates that the airplane is directly over the station. The latter indication will, however, be in the form of an ellipse with a right or left inclination, providing the airplane does not fly directly over the station.

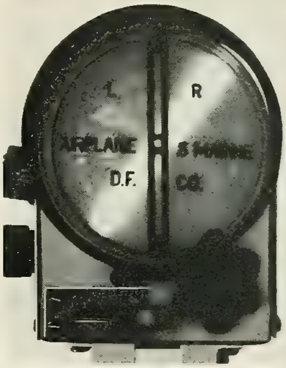


Fig. 3. Station to right of course or indicator pointer to right of null when obtaining radio bearing

By using the directional sensitivity control of the unit, the observer may, at will, make the directive response as critical or as sluggish as desired. This control is apparent to the observer in the amount of inclination of the beam to the right or left of its vertical alignment, and may be so set that deviating 1° from the course (or rotating the loop 1° from the null point) will cause any deviation of the vertical beam from 1 to 15-20°, depending on the directional sensitivity desired. This is advantageous when flying in rough weather, as the ballistic properties of the beam may be adjusted to suit the movement of the aircraft.

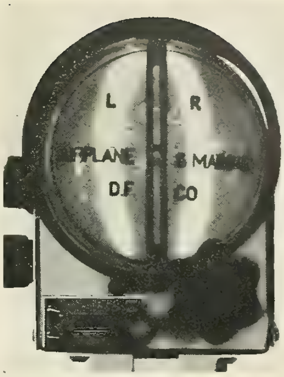


Fig. 4. Elliptical pattern indicating approach to the sending station

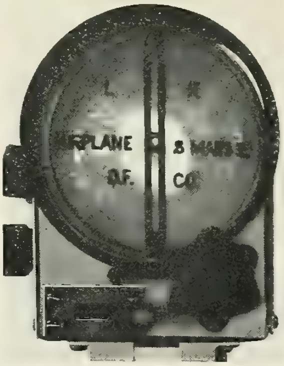


Fig. 5. Circular pattern made by the cathode ray when over the station

During the tests it was determined that the cathode ray direction finder affords means for a constant check on wind drift by coordinating the cathode indication with the setting of the directional gyro.

It was also noted that, while the presence of interfering signals and electrical atmospheric disturbances were indicated on the cathode screen, such disturbances did not detract from the accuracy of the indicator's prime function. On numerous occasions bearings were obtained on electrical storms quite as readily as on radio ground stations.

Equipment used during these tests consisted of loop antenna system and control; receiver unit; receiver remote control unit; visual indicator unit (cathode tube); power supply; interconnecting and control cables; and a complete set of accessories. Designation of the radio bearing, or "on course" indication, is shown by the cathode ray tube which consists of an electron gun whose emissions bombard the screen to cause a visual indication of the course.

The loop antenna is of the electro-

(*Continued on page* 84)

Increasing Possibilities for American Aircraft in the Canadian Market

●

ERNEST S. ROBERTS

Aviation Editor, British Columbia Journal of Commerce

● Canada is on the eve of a replenishment and extension program, and the imperative need of large numbers of modern aircraft for her commercial air services will not be forestalled much longer.

American manufacturers of flying equipment who study the Canadian scene may profit thereby, for there exists a market particularly for aircraft of two types—twin-engined passenger and express carriers for regular transport operations; single-engined "work-horses" for freighting.

The reasons that some American manufacturer or manufacturers may profit by a diligent study of Canadian needs and potential markets are threefold: Canada's immediate future development aeronautically; antiquated type of aircraft equipment is largely doing Canada's commercial flying at the present moment; and because of the aircraft types that are familiar to, and available to Canadian operators, to fill Canadian needs.

The British and Irish representatives did not, without good reason, form a delegation to meet Canadian authorities on their own soil, and then with the addition of Canadian representatives journey to Washington to discuss agreements in respect to trans-Atlantic air services. 1936 will see test flights across the Atlantic. 1937 will probably see the definite establishment of air service schedules across that ocean. The British Empire is keenly interested in this development, not merely to link the Canadian colony with the British Isles, but to extend the British air route across Canada to the shores of the Pacific Ocean. Thence, the all-red route may be plotted to the Orient, to southern Asia and Australasia, for who knows when international complications may force England to abandon her present air route to India, the Malay Peninsula, or to Australasia?

Canada, therefore, must create fast, dependable air communication between the Atlantic and Pacific Oceans, and fast-cruising twin-engined transports, suitable for carrying eight to ten passengers, mail and express, will be needed before long.

Before deciding whether existing types such as those familiar on domestic airlines in the United States are the answer, it must be remembered that Canada's transcontinental airway is almost ready for use; airports and emergency landing fields at suitable intervals are either in operation now, or require little extra work to make them immediately available for service. These airways may be satisfactory for the usual transport types we have been thinking about. But how many units would be required for this service? It may be that some other type would be more widely used in Canada if one can be developed that is also suitable for operation on secondary routes. Such an aircraft should be convertible as a landplane, seaplane and ski-plane.

There will be a number of inter-city routes not on the national airway system for which such a general-utility transport will be extremely useful. Passengers that have largely been flown in Canada have been the frontiersmen who have been prospecting for and developing mines; miners and mining officials flying to and from established mining communities; the trapper with his season's catch coming

Wright-powered Bellanca Aircruiser cargo transport used in Canada, convertible with skis, or twin floats

Bellanca Pacemaker provided with Edo floats for summer use

to the best fur markets; and surveyors, engineers and those contributing to the development of Canada's natural resources of forest, stream and mineral deposit.

Here are the possibilities for a medium-sized aircraft to serve the general-utility transport purpose. The plane must necessarily be rugged and easy to maintain, with flying characteristics that make it easy to handle in bad terrain. The terminus of its regular run may be some place that the American airline operator would consider entirely inadequate in size and grooming.

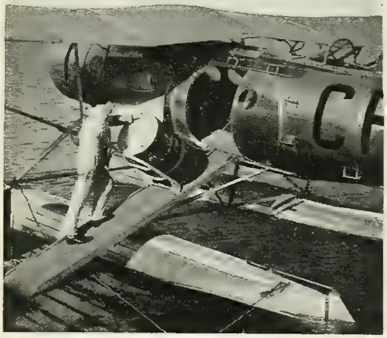
So much for aircraft that will be required on scheduled passenger, mail and express routes. Then there is the increasing need for the work-horse. But it's going to be a faster, more efficient vehicle than has been flying to and from Canada's outposts during the past years.

It has been estimated that there has been greater tonnage of air freight flown in Canada during 1935—in eight- nine- and ten-year-old Fokkers, Fairchilds and Junkers—than has been flown in all the rest of the world combined. Canada's air freighting is going to continue increasing, and the ten-year-old relics cannot continue to do the bulk of the freighting.

Single-engined aircraft seem suitable for this job because in every province of the Dominion, ninety out of a hundred aircraft operate from lakes in summer. In winter their skiis straddle poles laid on the snow or ice surface to prevent freezing. Whether the mechanic has to clamber out early in the summer morning to check her over and wind her up; whether he has to heat the engine and the oil he has extracted the previous night before the day's work can commence in sub-zero weather; whether it be in western British Columbia or eastern Quebec, you may be assured it's not often that there is a convenient hangar to shelter the ship, and no handy service facilities when it is out on operations. The mechanic's lucky to have a bit of a "nose hangar" to shelter him from the worst of the weather. So he for one is going to favor a single engine to service.

Most of the freighter airplanes of the past seven years or more have been capable of packing about half a ton. The need is going to become more pressing for the jobs that will pack a ton, a ton and a half, or two tons. Especially if more aircraft are going to be pressed into service to fly radium ores out of the far-north Great Bear Lake district, and on similar jobs.

Freighters must be substantially made and capable of standing up in a rugged country, under all weather conditions. The all-metal Junkers has proven a good aircraft for "bush" operations in Canada. But freight is going to demand more speed than the biggest percentage of commercial aircraft in Canada today can offer (in the neighborhood of 100 m.p.h.).



Canadian-built Fairchild freighter

The ideal freighter for Canadian operations must not only get out of small places in a hurry, but be able to sit down in them too. It must float in for a landing and get off quickly.

Give these freighters hatchways or doors that will enable them to take a complete diesel engine—lots of loading space. Give them at least a five or six hours' fuel supply.

Because of essential close-linking of units in the British Empire, the products of British aircraft factories will probably always enjoy some tariff preference. But conditions for which British aircraft are built are vastly different than those under which Canadian machines have to work. Factories in the old country are too busy to pay much attention to the Canadian market. Good aircraft can be built in England for Canadian requirements, but it still seems that American-built ships have the edge at present.

There are some good aircraft factories in Canada, too, which have designed good aircraft for Canadian use. Some are building American aircraft, and more will do likewise. But there's been so little purchasing of new aircraft in Canada, they haven't been able to do much about reducing the high first costs through mass production. Then, too, they are going to have a difficult job to design and build a sufficient variety of aircraft types to satisfy all the Canadian needs.

If there ever was, or ever will be, a time when consideration of the potential Canadian market is worth anything, now is that time. Used aircraft have been banned from importation into Canada for three years. Not one second-hand American aircraft has crossed the line to a Canadian buyer. Times have been difficult so there haven't been many new aircraft purchased. Planes have been patched and re-patched and operators have carried on to the best of their ability. But it is a foregone conclusion that there will be some aircraft junked in the next few years as it begins to appear that the depression has been left behind.

There is no way to predict whether or not the embargo on used aircraft will continue. The new Liberal Government in Canada is changing some of the policies of its predecessor, and most significant, is the move to encourage more trade between the United States and Canada. Tariff barriers aren't going to be quite so high.

All indications suggest that somebody who wants to sell some airplanes might find it well worth while to delve into the Canadian scene and get all the information on the subject.

Pilot Ginger Coote transfers his cargo to dog sleds

Glazing Problems in Aircraft Cabins

R. A. MILLER

Pittsburgh Plate Glass Co.

This article presents the problems involved in satisfactory airplane glazing. The multiplicity of sizes and contours demanded by the various aircraft manufacturers at present, almost preclude any standardization of set-up and renders still more difficult the devising of satisfactory apparatus for carrying out their general schemes. At least, serious and considerable thought is being given to the problems which may be anticipated. The hope of reaching satisfactory solutions for the various problems involved will depend to a large extent upon the assistance and cooperation of the aircraft companies.

● Problems of glazing aircraft cabins, both for ordinary and stratosphere flying, are becoming pressing. As a result, the following data covering the physical properties of glass and the several kinds of safety glass, as well as soundproofing and insulating properties, are presented to assist manufacturers to satisfactorily equip their ships.

From the data which could be tabulated, the coefficient of expansion of plate glass between —70° F. and +100° F. should be approximately .00000823 per ° C., or .00000451 per ° F. In other words, the coefficient of expansion of glass is approximately ⅔ that of steel and ⅓ that of aluminum.

Ordinary glass is approximately 6 times stronger in compression than in tension, or 36000 lbs./sq. in. to approximately 6500 lbs./sq. in. This means that bent glass with the pressure exerted upon the node of the bend would be materially stronger than flat glass or than the same bent glass with the load imposed at the nadir of the curve. The strength of glass in shear is not adequately known.

So far as could be determined the strength of glass increases directly with the square of the thickness and will be found to closely approximate

$$P = 21000t^2/Af$$

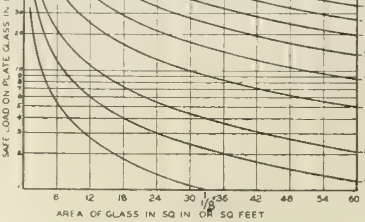
in which P = unit pressure; t = thickness of glass (in in.); A = area of glass (in in.^{2} or ft.^{2}) and f = factor of safety. If A is taken in ft.,^{2} then P is pressure per ft.^{2}; if A is taken in in.^{2}, then P is pressure per in.^{2} This formula is for square plates uniformly supported on all four edges and uniformly loaded. As yet, there has been no determination made of the actual increase in strength which may be anticipated from the use of bent glass and the safe load for flat glass of the same absolute area is habitually used.

Modulus of rupture of glass is commonly taken as 6500 lb./in.^{2}, mean average value. This may vary from 3500 lbs./in.^{2}, to 12000 lbs./in.^{2}, on samples cut from the same plate, and where prolonged loading is anticipated it is desirable to use a factor of safety of 10.

In arriving at a comparative value as between sheet glass, plate glass, laminated safety glass and tempered glass, extensive investigations indicate that there is little to choose between sheet glass, plate glass and the laminated products as regards static or uniformly distributed loading. In laminated glass, the plastic sheet lies approximately at the neutral axis of the laminated product and its lower strength is offset by the greater glass strength due to the actual surfaces of the glass lamellae. In general, the strength of glass increases directly with the square of its thickness, but this relationship is in some way modified by the ratio of surface to volume, so that within limits, thin glass shows somewhat greater strength than would normally be expected.

One-quarter inch thickness plate glass is usually considered the base thickness, this statement applying equally well to sheet glass, *Herculite*, and laminated safety glass. In this thickness, glass weighs approximately 3.29 lbs./ft.^{2}; other thicknesses weigh in direct proportion. Weight of multiple glazing depends upon the thickness of glass used in such glazing and the peripheral binding.

Duplate, the newest laminated safety glass, will withstand impact of a 2 lb. steel ball dropped from 8 ft. both at 0° F. and at 120° F. At normal temperatures of 75° F., this product will withstand impact of the 2 lb. ball at elevations of from 16 to 20 ft. When the normal test assigned for safety glass by the American Standards Association Tentative Code is used, new *Duplate* will withstand the impact of a .5 lb. ball dropped 35 ft., both at 0° F. and at 120° F. and will withstand the impact of the same ball, dropped from 85 ft. at normal temperatures of 75° F. At—25° F., new *Duplate* will withstand the impact of the .5 lb. ball dropped 10 ft. and at —54° F. it will withstand impact of the same ball dropped 4 ft.



Safe loads for plate glass, weight of glass to be deducted

Light transmission of ¼" *Duplate* is approximately 75% normal white light; in *Duolite* and *Aerolite* it is approximately 89%. In *Duplate*, there should be essentially no distortion, but in both *Duolite* and *Aerolite* there may be considerable since both are made up by laminating sheet glass.

Tempered glass is produced by heating up to approximately 1250° F. and then suddenly quenching to room temperature. Both operations must be completely uniform over the entire plate to secure satisfactory results. The process places the outermost surfaces of the glass under high compression and correspondingly places the central portion about the neutral axis under high tension. The greater strength of the product is due to the fact that the compression of the outermost surfaces must be overcome and then the normal strength of the glass must be overcome before breakage can be produced.

Indications are that the tempered glass *Herculite* will withstand temperatures up to 650° F. for an indefinite period without danger of spontaneous disruption. At temperatures above 650°, the strains are gradually relieved, and as the temperatures approach 950°, the type of break will approach that customary in ordinary glass. It may be quenched from the temperature of boiling water to the temperature of ice water without danger of breakage, for the process of herculiting reduces expansion to approximately .000005 per ° C. or .000003 per ° F.

Herculite will withstand the impact of an 11 lb. shot bag dropped 10 ft. and a .5 lb. ball dropped 16 ft. However, a half ounce dart with a 1/16" diameter hard steel nose will disrupt tempered glass when dropped approximately 5 ft.

Up to the present it has been impossible to temper glass with any considerable curvature, or to satisfactorily temper glass less than ¼" thickness. A considerable volume of 3/16" thickness has been tempered but it is materially less than half as strong as the ¼" *Herculite* and is not recommended. When *Herculite* is broken, it is completely broken and offers no protection against the elements, disrupting into small cubical fragments with more or less rounded edges. In breaking, it tends to bind itself somewhat more securely into the frame, unless the impact is sufficient to penetrate through the glass. It is readily broken by the impact of small sharp objects at relatively high velocity, although it resists impact with objects of considerable mass and widely distributed surfaces of impact.

Investigations thus far conducted upon the strength of glass indicate a wide variation from the mean or average value, which may be as much as 100% above that average or 50% below it. The value given before (6500 lbs./in.^{2} tensile strength) is a mean average value. Apparently, otherwise perfectly normal plate glass has been found which will withstand 12000 lbs./in.^{2} and correspondingly otherwise perfectly normal plate glass has been found which would withstand only 3500 lbs./in.^{2} This latter value appears to be a minimum so far as present information indicates. *Herculite,* however, seems to be materially more uniform than the original glass from which it was fabricated, and both compression and tensile strength appear to be about 36000 lbs./in.^{2} The compression strength of the annealed glass is also approximately 36000 lbs./in.^{2}, while for both the annealed product (whether laminated or not) and the tempered product (*Herculite*), the modulus of elasticity appears to be between 10,000,000 and 11,000,000.

Where a factor of safety of less than 10 is used, failures occur often enough to be serious. When a factor of safety of 10 is used, some extraneous and unusual condition is required to cause failure of the glass under stress. Fatigue seems to play a considerable part in strength, and the values given before for the moduli of rupture have been determined under what might be considered instantaneously-applied load. As the time of loading is increased, the modulus of rupture of the glass in question decreases markedly. Yet, the absolute limit of these fatigue values has not been determined, but on the basis of past experience, the use of a factor of safety of 10 in the accompanying formula will satisfactorily meet the probable fatigue values which may eventually be determined.

The distinctive streamline cabin of the Beechcraft which pioneered in the use of a curved front windshield

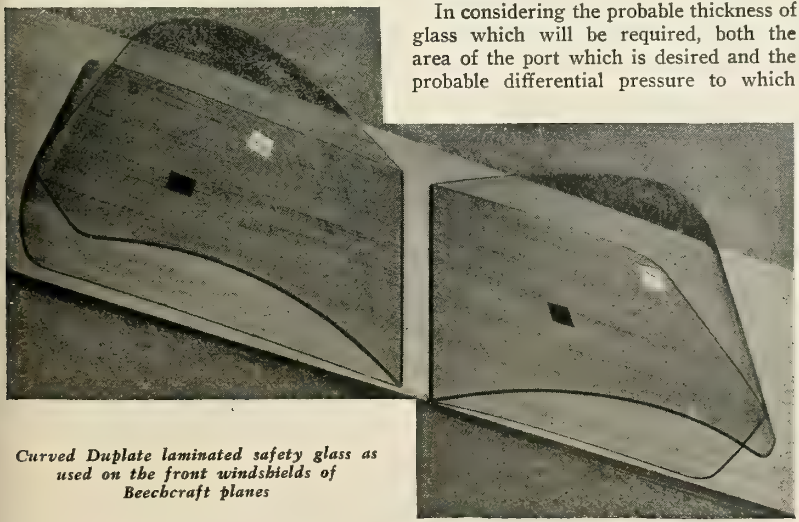
In considering the probable thickness of glass which will be required, both the area of the port which is desired and the probable differential pressure to which the glass will be exposed, must be considered. Therefore, a 15" diameter circular port with an internal unbalanced pressure 7 lb. greater than the surrounding pressure, and using tempered glass, would have to have a glass thickness at least ⅜". If ordinary glass is to be used, the thickness would have to be ¾".

Herculite ¾" thick in the size 15" × 15" will withstand one full atmosphere pressure differential, which, of course, will not be attainable with any airplane unless the pressure within the ship is greater than one atmosphere. For regular glass of the indicated dimension to withstand one full atmosphere pressure, the glass would have to be 1½" thick, which is not commonly available. In glazing the pilot's compartment, 1¼" thick plate glass may be used in a windshield 14" × 48" to withstand rather more than ½ atmosphere pressure.

The accompanying chart of safe loads for plate glass applies equally well to plate glass, sheet glass or laminated glass. For wire-inserted glass, the safe loads shown for any given area and thickness must be divided by 2. For *Herculite,* the safe loads shown for any given area and thickness may be multiplied by 4.5. For rectangular plates, load values in the chart may be increased by these factors:

Short Side / Long Side	Factor	Short Side / Long Side	Factor
.9	1.005	.4	1.45
.8	1.02	.3	1.8
.7	1.07	.2	2.6
.6	1.14	.1	5.0
.5	1.25		

(*Continued on page* 82)



Curved Duplate laminated safety glass as used on the front windshields of Beechcraft planes

Maintenance Procedure At American Airlines' Chicago Base

●

● Most of the major airlines have standardized on flying equipment, operating one or two types of planes. American Airlines, in the past, however, found that the diversification of its service on main and feeder-line routes made it necessary to operate Stinsons, Vultees, Condors and Douglases to fulfill the peculiar schedule requirements of its extensive system.

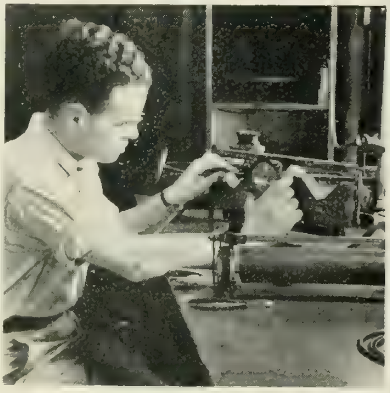
Inasmuch as the variety of planes operated tends to make the matter of overhaul and maintenance a complicated problem, the maintenance department was reorganized and concentrated at the Chicago Municipal Airport where all executive, sales and general office personnel are based.

The maintenance system as a whole has been divided into five major bases—at Chicago, Newark, Ft. Worth, Glendale and Cleveland—with H. D. Ingalls as Superintendent of Maintenance. Responsible to him, at the respective bases, are Maintenance Supervisors F. J. Hoyt, W. C. Ray, Frank Ware and H. B. Taylor, as well as Chief Mechanic Joseph Healey. C. H. Muth as Assistant Superintendent of Maintenance is responsible, among other things, for keeping track of all the planes used throughout the system and notifying Operations as the periods approach for engine changes, major checks, etc.

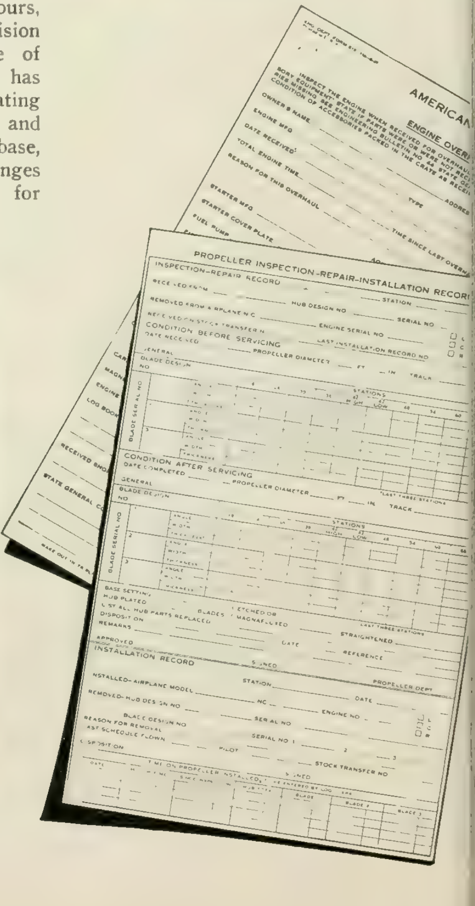
Mr. Ingalls is in charge of the entire maintenance department (including the five bases), inspection and maintenance of flying equipment, hangars and ground equipment. His duties include supervision of engine overhaul and instrument reconditioning; drafting, follow-up and recording of engineering changes for contacting manufacturers regarding claims on defective materials and material which becomes unserviceable prior to limit of life expectancy; contacting the Department of Commerce in connection with approval or repairs and maintenance, licensing equipment, and securing waivers when necessary to meet operating requirements; coordination with the personnel director, the superintendent of stations in connection with maintenance personnel at field stations, and the operators department in routing schedules. The manufacture of parts and servicing of repair equipment, is also under his supervision.

Each of the five bases is responsible for the daily check of all planes at their stations, for major checks every 60 hours, origination of trouble reports, supervision of stock and general maintenance of planes and equipment. Newark base has the added responsibility of coordinating with operations in routing aircraft, and Chicago the principal maintenance base, is responsible for all engine changes which are made every 400 hours, for manufacturing and for maintenance checks on test flights.

While not centrally located on the airline (as far as the time element is concerned) Chicago is only overnight from



Instrument inspection



AMERICAN

ENGINE OVER

INSPECT THE ENGINE WHEN RECEIVED FOR OVERHAUL

OWNER'S NAME

ENGINE MFG

DATE RECEIVED

TOTAL ENGINE TIME

REASON FOR THIS OVERHAUL

STARTER MFG

STARTER COVER PLATE

FUEL PUMP

TYPE

TIME SINCE LAST OVERH

RECEIVED SHO

STATE GENERAL C

PROPELLER INSPECTION-REPAIR-INSTALLATION RECOR

INSPECTION-REPAIR RECORD

RECEIVED FROM

HUB DESIGN NO

STATION

REMOVED FROM AIRPLANE NC

SERIAL NO

ENGINE SERIAL NO

CONDITION BEFORE SERVICING

DATE RECEIVED

LAST INSTALLATION RECORD NO

GENERAL

PROPELLER DIAMETER

FT

IN

TRACK

BLADE DESIGN NO

BLADE SERIAL NO

STATIONS

HIGH

LOW

CONDITION AFTER SERVICING

DATE COMPLETED

GENERAL

PROPELLER DIAMETER

FT

IN

TRACK

BLADE DESIGN NO

BLADE SERIAL NO

STATIONS

HIGH

LOW

ANGLE

WIDTH

THICKNESS

LAST THREE STATIONS

BASE SETTING

HUB PLATED

LIST ALL HUB PARTS REPLACED

BLADES

ETCHED OR MAGNAFLUXED

DISPOSITION

REMARKS

STRAIGHTENED

APPROVED

DATE

REFERENCE

INSTALLATION RECORD

SIGNED

INSTALLED—AIRPLANE MODEL

STATION

PROPELLER DEPT

REMOVED—HUB DESIGN NO

NC

DATE

BLADE DESIGN NO

SERIAL NO

ENGINE NO

REASON FOR REMOVAL

LAST SCHEDULE FLOWN

SERIAL NO 1

2

3

DISPOSITION

PILOT

STOCK TRANSFER NO

TIME ON PROPELLER INSTALLED

SIGNED

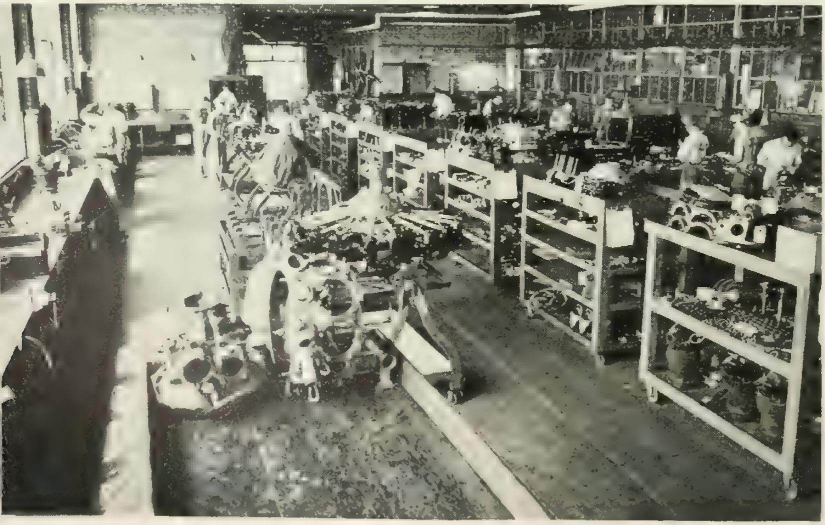
DATE

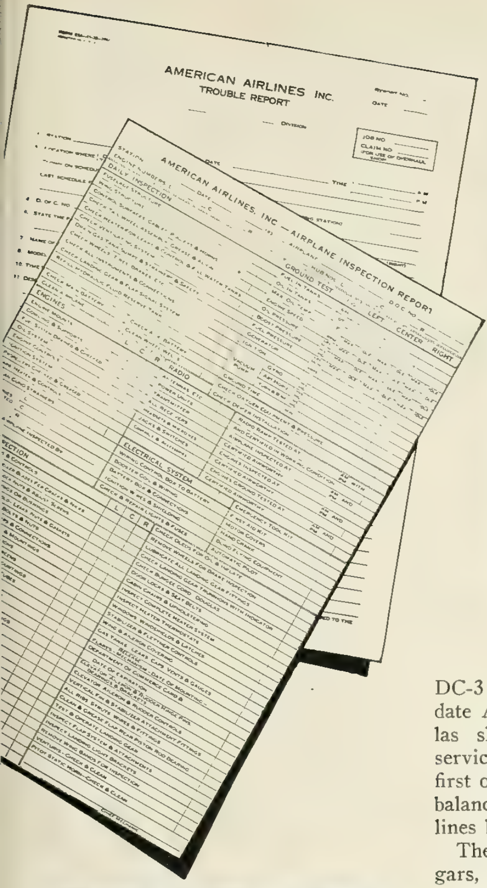
BLADE

BLADE 2

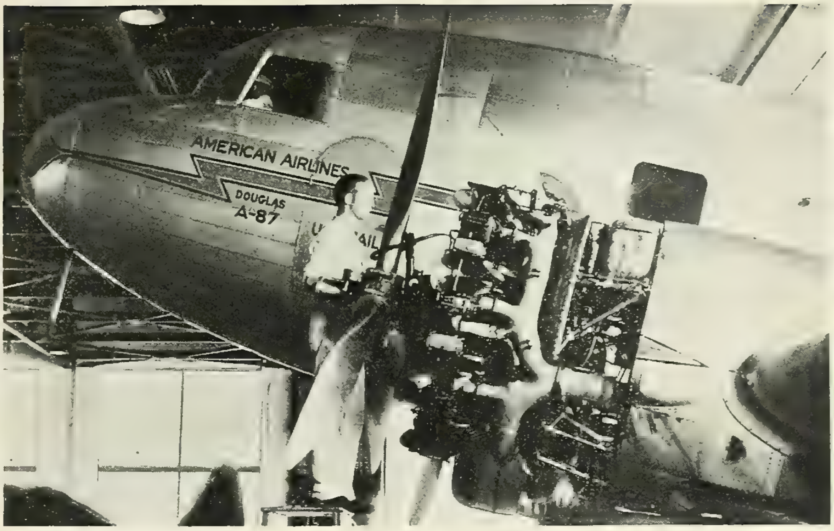
BLADE 3

American Airlines' Engine Shop




AMERICAN AIRLINES INC.
TROUBLE REPORT

AMERICAN AIRLINES, INC.—AIRPLANE INSPECTION REPORT



Routine inspection and engine maintenance

General overhaul

the West Coast and four hours from the east. It is at this base that the engines of the Douglas DC-2's, DC-3's and DST's, of the Stinson A's and Vultees undergo their periodic changes, the work involving complete disassembly, repair, inspection, and assembly of geared and direct-drive Cyclones and Lycoming engines.

At present, no planes are completely overhauled at Chicago. DC-2's are returned to the Douglas factory in Santa Monica every 2500-3000 hours for a complete overhaul. Vultees and Stinsons, however, will be retired before their 2500-3000 hour period is up and will be replaced by the new Douglas DST and DC-3 transports now being delivered. To date American Airlines has eight Douglas sleeper planes and 15 DC-2's in service. Delivery has been taken on the first of 12 DC-3 Flagship day planes, the balance to be delivered to American Airlines by the first of October.

The Chicago base consists of two hangars, each 200′ × 150′ with an addition of about 30′ on each providing several floors for office space.

Hangar One (4848 W. 63rd) houses the executive offices, and personnel of the engineering, publicity and general administrative departments. The purchasing, teletype, reservation and operations offices are also in this building as is a small stock room which is located on the hangar floor. The hangar houses DC-2's which are so routed that one is receiving its 60-hour major check every night. All planes based at Chicago are given their daily check sometime each 24 hours.

Hangar Two (5036 W. 63rd) provides for operations and maintenance administration personnel. In this building, planes due for engine changes are brought onto the main floor of the hangar. The engine, complete with its mount, is detached from the plane, fitted on a portable rack and a completely overhauled engine is substituted. The ship is then serviced for flight, the procedure necessitating the removal of the plane from service for only one day.

The engine being overhauled is completely disassembled; parts are sprayed and immersed in oleum until clean; steel parts are magnafluxed, necessary replacements made, and assembly started following a regular production line procedure. Accessories such as generators, carburetors, magnetos, vacuum pumps, starters, etc., are inspected, tested, replacements made and installed during the assembly of the engine. An average of approximately 110 man hours are required to assemble the F3A geared Cyclones, 100 hours for F2A direct-drive Cyclones, and 65 hours for the R-680-5 Lycomings. Continuing along the production line, the engine is next installed in the mount from which it was removed, the installation of a Cyclone requiring about 30 hours. Copper fuel and oil lines are annealed before installation, and all are inspected and replaced when there is any doubt of their proper condition. The propeller is mounted last and the unit is then ready to be fitted to a plane.

Propeller service requires complete disassembly, magnafluxing of hubs, inspection of parts and grinding and burnishing of nicks. It has been found from experience that length of service of propellers varies considerably with the individual blade, the maximum being about 3000 hours on the Douglas.

L. W. Purney, inspector of the Chicago base station, is also responsible for the inspection of flying and ground equipment throughout the system. His duties include standardization of maintenance and inspection procedure; insurance of safety of operation through rigid check of flying equipment; checking to insure proper maintenance of ground equipment; and checking of stock inventory.

R. P. O'Neal, foreman of engine overhaul, is in charge of this work, including the keeping of engine records, propeller overhaul, supervision of the machine shop, reconditioning and inspection of engine parts and accessories, overhaul of radio power units, and receiving and preparing engines for shipment.

Welding and paint shops, upholstery, battery and radio departments, and an instrument section are located in the main shop. The recently completed instrument department, supervised by D. S. Tilden,

The Instrument Department and Magnaflux inspection

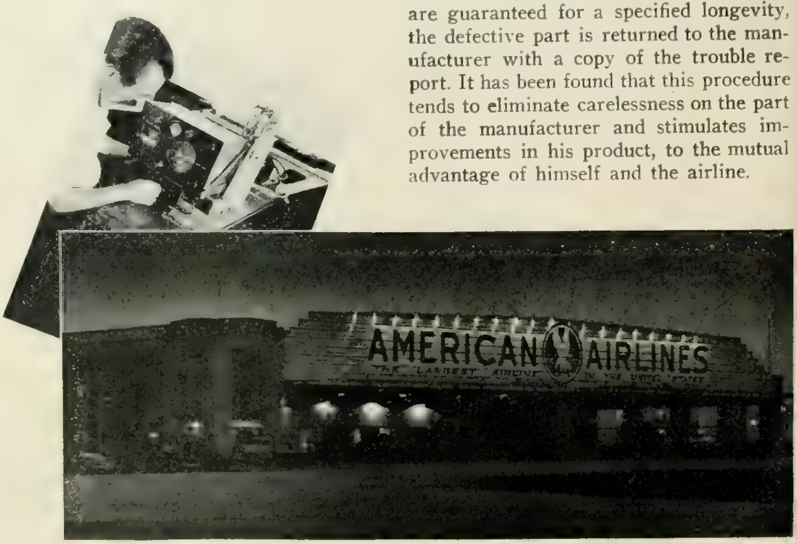
is an air-conditioned unit with individual work benches and the latest equipment for repair work, as well as facilities for keeping instrument records. Since the advent of the DST's which are equipped with Sperry gyropilots, a special testing machine, built by the Sperry Gyroscope Corp., has been installed which duplicates all movements and attitudes possible through the three axes of a plane. The gyropilot unit is removed from the plane and placed in the testing apparatus where it is adjusted and observed for two 4-hour periods to assure its accurate functioning.

The battery department not only is responsible for maintenance of these units and their upkeep, but also for continual experimentation aimed at their improvement. The radio department conducts a daily check of all radio equipment, checks trouble reports, and overhauls equipment during every engine change unless trouble develops before that time.

Major checks on the Stinson Airliners and Vultees are also made in this hangar at 60-hour intervals. In checking, an inspector goes through the entire inspection list, and notes any trouble. After the trouble has been remedied, a second inspector makes an independent recheck of the complete list, thus minimizing the likelihood of personnel failure.

It is necessary to carry only a small stock of replacement parts, as sources of supply are no further than overnight on the line. Only parts that cannot be replaced or repaired in a few hours, or which may be required in the major check and engine change procedure, are stocked. At every stop on the line such spare parts as cylinder heads, etc., are carried as may be needed to continue schedules.

H. D. Ingalls, Superintendent of Maintenance, American Airlines



Gyropilot testing, and one of the Chicago hangars

Close Cooperation

American Airlines has found it advantageous to have the engineering department work closely with the maintenance department. Several interesting developments have resulted from this cooperation; for example, all of the DST's and DC-3's are fabricated with the A 17 S-T rivets recently developed by the Aluminum Company of America. These rivets are treated with a coating of zinc chromate primer (which protects and identifies by its color), have ⅝ the strength of 17 S-T rivets originally used, but which can be used in the "as received" condition anytime on the field without the necessity of further heat treatment. While this necessitates the use of a slightly larger rivet, cost and weight is more than compensated for by the fact that any base can repair, without delay, any riveted members where heat treatment and ice storage of rivets formerly was necessary.

Adding New Features

When the Douglas Aircraft Corp. developed new fins and rudder which eliminated the weaving tendencies of the original DC-2's, American Airlines routed their planes through the factory so this change could be incorporated. The same procedure was followed when a new aileron was developed. Any new developments are used in the equipment of a test plane on which engineering changes are examined completely before they are either discarded or adapted for the other planes on the line.

Where there is evidence, in service, of poor workmanship or defective parts such as radio tubes, spark plugs, landing gears, tires, engine parts, etc., the station manager at the base where the trouble is experienced, submits a trouble report to Chicago headquarters. In his report he not only makes recommendations for preventing reoccurrences of the particular trouble, but also describes what occurred and the damage, and if possible, the probable cause and where the responsibility should be placed. Copies of these reports are sent each month to every station manager, chief mechanic, etc., the final disposition of the case being held up until responsibility for the deficiency is, if possible, determined. Where there are engine or accessory failures due to parts which are guaranteed for a specified longevity, the defective part is returned to the manufacturer with a copy of the trouble report. It has been found that this procedure tends to eliminate carelessness on the part of the manufacturer and stimulates improvements in his product, to the mutual advantage of himself and the airline.

AIR— HOT AND OTHERWISE

Washington, Wake Up!

FRANK A. TICHENOR

● England already has voted $940,000,000 this year for army, navy and air force appropriations, but in addition to that the British Home Office is seeking $4,435,000 for the production of gas masks. The English plan is a gas mask not only for men in the military service, but also for every woman and child in Britain! Let our alleged protectors in Washington think about this, if thinking is possible in Washington at this time.

Europe, today, is on the brink of another world war, and while Roosevelt says "neutrality for the United States," remember Wilson was re-elected on the slogan "He kept us out of war." After he was elected, we joined the most horrible catastrophe in the history of the world. Roosevelt wants to be re-elected and he'll promise anything. War is just as sure to come as the wild extravagances of the present administration will cause our taxation to mount higher—higher—and even higher.

England is merely following the example set first by Germany and then followed in turn by France, Italy and the rest of Continental Europe. We, in this country, still labor under the blissful delusion that there is little or no possibility of our ever being subjected to an air raid. But there is no denying that the threat exists, and we must be prepared for any contingency that may arise as a result of the ability of the airplane to fly great distances in short time.

Judging from our past experience in gas mask development it is going to take several years to develop a civilian mask and get it into production in sizable quantities. And who can predict what may yet happen in the way of aircraft development and distances capable of being travelled by planes? Aircraft development is in the capable hands of commercial companies who are spending immense sums of money on research and development. On the other hand military gas mask development in this country has been confined almost solely to Government activity, practically nothing having been done in the way of developing cooperation with the commercial concerns who, in the event of an emergency, will have to be depended upon to supply gas masks, both for military and civilian use.

Great Britain paid scant attention until recently to the possibility of the distribution of poison gas from aircraft flying at high altitudes and the necessity for providing protection for its civilian population. She suddenly woke up to this possibility and during the past year has frantically bent her efforts to alleviate the dangerous situation. British Chemical Warfare Service has devised minimum specifications for a cheap civilian mask to give civilians protection for short periods, rather than for the longer periods required of military masks.

It is a fact that we are not subjected to the same militaristic hazards that the European countries and the British Isles are—nevertheless we are not as immune to aerial gas attacks as most of us would like to believe and the American public should be stirred up to the consciousness of such a possibility. We should be taking steps to prepare for it and not get caught napping.

Industrial concerns in France provide gas masks for their employees who are required not only to take training with them, but also must acquaint the civilian population with their use.

Before a gas mask may be sold for civilian use in France or Germany it must pass the approval requirements and receive a Government certificate of worthiness. In France seven types of civilian masks have been approved and are offered for sale in convenient places, such as drug stores, etc. The Government maintains supervision over the plants manufacturing these masks and sees to it that a certain standard of product is maintained.

In addition to all this, Germany and France are also providing underground dugouts in thickly populated centers. These dugouts are air conditioned, so as to clear the incoming air of poisonous and noxious gases.

All of the European countries now have one or more military mask factories, either operated by, or under the direct supervision of the Government. Each country tries to keep at least the canister part of its mask secret, because each is striving to develop new gases against which the masks of their most probable enemy will offer no protection. Going another step forward they are also striving to improve their mask's canister so it will offer protection against all the possible gases that their probable enemy may develop and use.

Our Federal Government should and can do the experimental work, leaving the actual manufacturing of gas masks to industry. However, we cannot expect industry, without having any knowledge, information or experience, to start producing millions and millions of gas masks, and steps should be taken by the Federal Government to remedy this situation. If the present regulations of our chemical warfare service do not permit this, they should be changed at once so that there is more freedom in developing real cooperation with the industry.

We are spending billions in the United States for alligator baths, apartment houses for dogs, gold fish propagation, and millions and millions on other fool experiments. A small part of these expenditures used in the development and research work of gas masks may save the lives of millions of our citizens, although the loss of lives to such administrators as we now have in control of our Federal activities means little—to witness—the loss of twelve pilots in the Army Air Corps air mail experiment.

Washington, Wake Up!

An air raid and gas attack, from H. G. Wells' motion picture, Things to Come

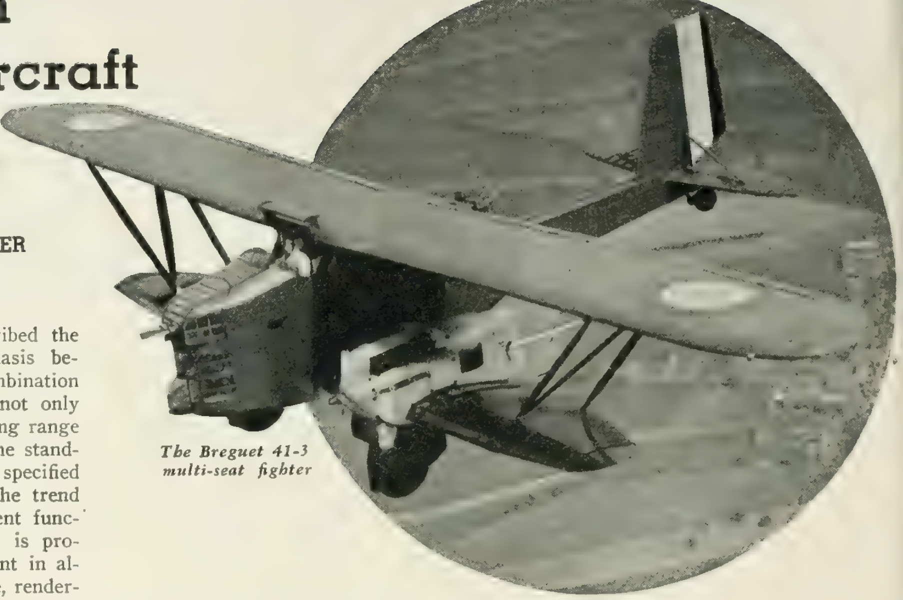
French Military Aircraft

(Part 2)

●

PEYTON M. MAGRUDER

● Part I of this article described the various French fighters, emphasis being placed in the multi-place combination type. Planes in this class are not only fighters and bombers but also long range observation ships, which from the standpoint of aerodynamic design and specified military mission, are unique. The trend toward a combination of different functions (while not entirely new) is pronounced in France and is evident in almost every type of military plane, rendering it difficult to differentiate between planes of one classification and those of another. There are, however, a few types, such as the light reconnaissance (observation) class and the night bomber, which do not fall definitely into a combination category, and these will be considered separately.



The Breguet 41-3 multi-seat fighter

Night (Heavy) Bombers

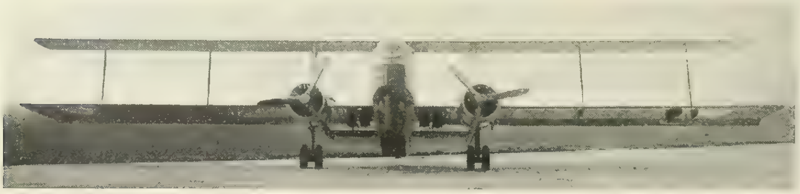
French night bombers, like the British heavy or night bomber, are designed to carry heavy bomb loads for long distances either during the day or night. With the exception of the Loiré-et-Olivier biplane Le O-208, all planes of this type are monoplanes of similar design to the multi-place combination fighter-bomber-observation class. Pilot and co-pilot are located above and just forward of the wing; in the extreme nose is a turret for a gunner-bomber and aft are enclosed gun positions, both above and below the fuselage, mounting twin machine guns in each emplacement. The increased size of the night bomber over the multi-place fighter results in a considerably lowered speed, but a much larger bomb carrying capacity without lessening defensive armament.

The four-place Marcel Bloch 200 is designed for two Gnôme-Rhône 14 Kdrs radial air-cooled, geared, and supercharged engines developing 925 hp each. Approximately 3000 lbs. of bombs and armament may be carried. Empty weight is 8570 lbs., maximum speed 181 mph, cruising range 620 miles and absolute ceiling 30,000 ft. The 201 is similar except that two 860 hp Hispano-Suiza 12 Ydrs liquid-cooled engines are employed instead of the radials in the 200 type. The 202 is an experimental model resembling the 200 except that four 7 Krsd radial, air-cooled, supercharged, and geared engines are used.

The Bloch 211, one of the latest types, is a four-place twin-engined night bomber fitted with 850 hp 12 Ydrs engines. This bomber, while similar to others of this type, has retractable landing gear and controllable-pitch propellers. Maximum speed is 217 mph at 15,000 ft., range 600 miles, absolute ceiling 29,000 ft., and empty weight 9900 lbs. Climb to 19,680 ft. requires 22 min.

The Farman F-221 is an all-metal five-place four-engined high wing bomber with 700 hp Gnôme-Rhône 14 Kbr radial engines mounted below the wing in tandem. The unusual feature of this bomber is its size and large bomb carrying capacity, useful load being in excess of 13,000 lbs. with all bombs carried inside the fuselage. Maximum speed is 171 mph, range 850 miles, and absolute ceiling 26,240. Empty weight is 18,200 lbs. General design of

Loiré-et-Olivier Le 0-208

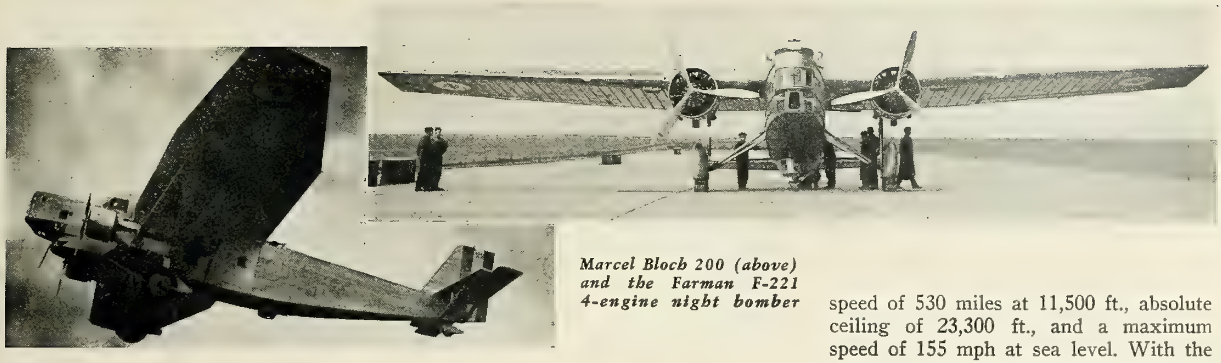


TYPE	Max. Speed (mph)	Total hp	Weight Loaded (lbs.)
NIGHT (HEAVY) BOMBERS			
Amiot 142 M*	196	1300	18,480
Amiot 143 M*	189	1720	15,075
Amiot 144 M*	221	1720	16,500
Marcel Bloch 130*	230	1800	13,475
Marcel Bloch 200	181	1860	15,730
Marcel Bloch 211	217	1700	16,500
Breguet 460	250	——	18,055
Farman F-420*	217	1600	15,180
Farman F-221	171	2800	39,160
Farman F-222	202	3200	41,140
Loire-et-Olivier Le 0-208	202	1740	18,700
Potez 54*	208	1800	13,130
RECONNAISSANCE (OBSERVATION)			
Breguet 27-A2	147	500	8,560
Breguet 27-3	155	650	7,960
Breguet 27-3	193	850	7,200
Breguet 27-4	194	700	7,000
Latecoere 491	171	650	5,660
Mureaux 113-R2	199	850	5,515
Potez 39-A2	193	850	5,830
NAVAL TYPES			
Bleriot 5190	136	2600	49,500
Breguet Bizerte	149	1935	33,000
C.A.M.S. 372	109	500	6,600
C.A.M.S. 551	124	1260	15,400
C.A.M.S. 110	149	1700	19,250
Farman F-271	155	1600	20,900
Latecoere 290	124	650	10,230
Latecoere 381	130	1300	20,400
Latecoere 491	171	650	5,655
Lavasseur P.L. 101	124	600	6,930
Lavasseur P.L. 200	143	750	7,700
Loire-et-Olivier Le 0-259	161	1720	25,080
Loire-et-Olivier H-23-2	130	650	8,800
Loire 70	135	1650	25,300
Loire 130	142	850	7,172
Nieuport 140-C2	215	690	5,500
Potez 452	138	350	3,520
Bloch 210	203	1860	16,720

* Combination night bomber-observation-fighter.

FRENCH COMMERCIAL TRANSPORTS

Make, Type, Number of Engines	Total hp	Places	Max. Speed (mph)	Normal Range (miles)	Weight Loaded (lbs.)
Bloch 300 (3)	2700	34	220	854	24,300
Breguet 39T (3)	1050	12	174	621	12,100
Breguet W-670 (2)	1640	21	217	600	17,000
Breguet Fulgur (2)	1640	16	239	560	14,907
Caudron C440 (2)	420	8	180	1242	7,280
Dewoitine D-620 (3)	2640	34	217	550	26,100
Farman F-431 (2)	380	7	168	560	5,400
Potez 56 (2)	370	7	174	683	6,100
Potez 62 (2)	1740	8	202	1056	15,750



Marcel Bloch 200 (above) and the Farman F-221 4-engine night bomber

this bomber also follows other bomber or multi-place fighter types. The F-222 is a more recent and higher performing modification of the F-221, having 14 Krsd engines and a retractable landing gear. Range is 1242 miles and absolute ceiling 27,300 ft., climb to 19,680 ft. requiring 24 min.

The Loiré-et-Olivier Le O-208 is an equal span four-place twin engined night bomber with 875 hp (at 13,000 ft.) 14 Kirs or 14 Kjrs engines mounted in nacelles projected forward from the lower wings. The landing gear retracts backward into the engine nacelles, and the tail wheel is also retractable. Either Ratier or Gnôme-Rhône controllable-pitch propellers are employed. The upper wing has half the chord and area of the lower, and ailerons and flaps are placed on the lower wing only. The crew of four is carried in the usual positions for the bomber type. Heavy bombs are carried internally while lighter bombs are placed in racks below the underslung portion of the fuselage. Useful load is approximately 9200 lbs. and maximum speed 202 mph. At cruising speed, maximum range is 1242 miles.

Reconnaissance (Observation) Types

Light observation or reconnaissance planes may be divided into two types differing mainly in design and construction rather than in duty or military purpose. The most predominant and unusual type, as exemplified by the Breguet 27 series, is a two-place single bay cantilever sesquiplane first adopted in 1929 and later modified and improved to incorporate more powerful engines and heavier armament. This type features a tail unit mounted on a single steel box girder to increase the angle of fire of the observer in the rear cockpit and to reduce tail assembly drag. Upper wing structure consists of two identical "I" section steel spars rigidly interconnected with "X" bracing. Ribs are of special steel in three sections riveted to small bridges which are in turn riveted to the single vertical corrugated web of the spars. The lower wing is a one-piece unit built up from a single tapering steel box spar. Fuselage is a built up steel box girder attached at the front end to a central box unit, which also carries the engine unit. Aft of this box is the secondary structure (for the crew) built up on a girder with a frame-work of steel and dural sheet covering. Fuel tanks are in the lower wing and may be released or dropped in an emergency.

Breguet 27-A2 is powered with a 500 hp Hispano-Suiza 12 Hb twelve-cylinder Vee water-cooled engine. Empty, it weighs 3860 lbs. and 8560 lbs. loaded with full equipment. Absolute ceiling is 25,400 ft., range 400 miles and maximum speed 147 mph at 10,000 ft. Breguet 27-3 is similar in construction to the A2 and is specially equipped for long distance reconnaissance bombing. Either the 650 hp Hispano-Suiza 12 Nb or the supercharged 12 Ybrs engine may be installed, the former giving a range at cruising speed of 530 miles at 11,500 ft., absolute ceiling of 23,300 ft., and a maximum speed of 155 mph at sea level. With the 12 Ybrs, maximum speed is 193 mph at 16,500 ft. and absolute ceiling 31,500 ft. with a load of 2800 lbs. Weight empty is 4130 lbs. with the 12 Nb engine. The 27-4 is fitted with a 700 hp Gnôme-Rhône 14 Krsd geared and supercharged air-cooled radial engine, performance being similar to that of the 27-3 when equipped with the Hispano-Suiza 12 Ybrs.

The second type of observation plane is a two-place reconnaissance high-wing braced monoplane of standard appearance and design. The all-metal wing structure consists of two box spars, 8 fore-and-aft Warren type girders, built up of "U" section dural members and lateral "U" sectioned stringers, covered by a thin duralumin sheet riveted to the spars and stringers. The leading edge is built up separately back to the front spar and may be quickly detached for inspection of the wing structure. Fuselage is of rectangular shape with a structure consisting of transverse bulkheads built up of dural "U" sections joined together with 4 sectioned longerons, also of "U" section, and covered with dural sheet in longitudinal and lateral strips along the sides and across the domed top and bottom. This method of construction eliminates the need for specially shaped covering and facilitates emergency repairs in the field which may be made with ordinary dural sheet. "U"-sectioned stiffeners are riveted to the exterior of the fuselage covering.

The Mureaux 113-R2 is of this type. It is equipped with an 850 hp Hispano-Suiza 12 Ybrs engine. Armament consists of

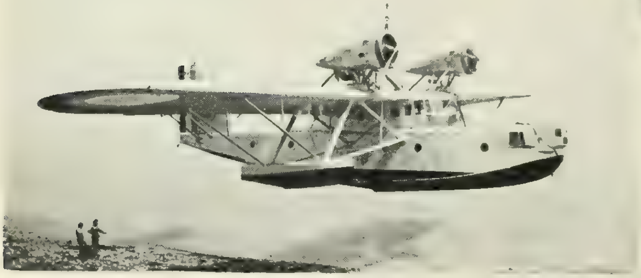
Potez 39-A2 two-seater with a 650 hp Hispano-Suiza

The Breguet 27-A2 with a Hispano-Suiza 500 hp V type engine two fixed machine guns in the wing firing forward through the propeller disc and a Scarff-mounted machine gun in the observer's cockpit. Maximum speed of 199 mph is obtained at 16,400 ft. Ceiling is 34,800 ft., range 620 miles, and time to climb 16,400 ft. is 8.5 minutes. Equipped with an 850 hp 12 Ycrs *moteur canon* this type is used as a two-seat fighter having a maximum speed of 211 mph. It weighs 3,630 lbs. empty.

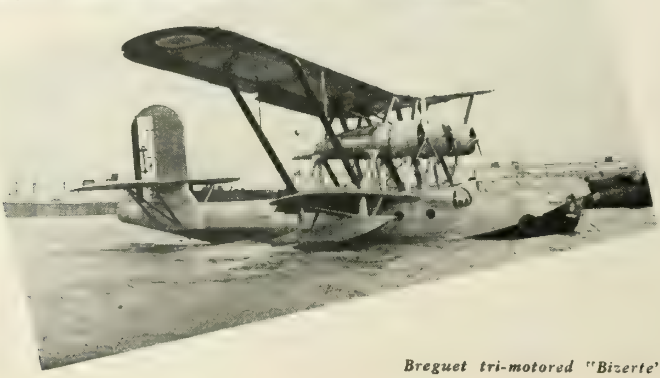
The Potez 39-A2 is similar in appearance and design to the Mureaux 113-R2. Constructional details differ only in the use of a Clark YH wing section consisting of two spars, diagonally placed drift struts, widely spaced ribs, and stringers placed between and parallel to the spars. The wing center section is cut away to provide good vision upward for the pilot. Fuselage is built up of open rectangular sections riveted together with gusset plates and covered with corrugated duralumin sheet. The landing gear is conventional, with shock strut members from the axles to upper longerons at the engine fire wall. A number of supercharged and geared engines may be used, including the 12 Xbrs, 12 Ybrs, and Lorraine 12 Hars, horsepower ranging from 500 to 800. Armament consists of two Vickers forward, twin Lewis guns on a rotatable ring on the rear cockpit and a fifth gun placed so that it fires aft through the floor of the cockpit. Best performance is obtained with the 12 Ybrs engine, giving a maximum speed of 193 mph at 16,400 ft., absolute ceiling 34,400 ft., and cruising range of 460 miles.

Latécoère 491 is a two-seat long range high-wing braced reconnaissance monoplane, armament being similar to that of the Potez 39-A2. Equipped with a 650 hp Hispano-Suiza 12 Nb Vee engine, maximum speed is 171 mph, absolute ceiling, 26,250 ft., and range 580 miles.

C.A.M.S. type 110



Loire 70 flying boat



Breguet tri-motored "Bizerte"

Flying Boats and Naval Types

There are a great number and variety of seaplanes used in conjunction with the French Navy. Among these may be mentioned the torpedo bomber, patrol-reconnaissance, shipboard fighter and dive bomber, amphibion observation, shipboard reconnaissance flying boat, deck landing reconnaissance, and the three- and four-engined reconnaissance flying boats. There are at least 10 companies manufacturing seaplanes of various types for the Navy and commercial airlines. Space limits any attempt to fully describe these planes, some of which are illustrated herewith. However, a few of the most unusual models will be described in the brief digest given below.

The Breguet *Bizerte* is a standard tri-motored long range reconnaissance patrol-bomber flying boat carrying a crew of 7. Wings are of sesquiplane arrangement of standard Breguet construction except that control surfaces are hinged to the rear spar of the upper wing. Trailing edge of the wing is hinged with the outer sections acting as ailerons and the inner sections as camber-changing flaps balanced by the Flettner principle. Hull is of standard Short-type construction embodying two steps and complete longitudinal structure so that the interior is comparatively free from obstructions. The bomber-gunner is placed in a nose cockpit with the pilot and co-pilot sitting side-by-side. Inside of the hull are radio and navigation compartments, a two-berth cabin and lavatory, officers' quarters with two bunks, a gallery and workshop, and amidships the gunner's cockpit. In the extreme tail is another gunner position similar to that in the Bristol 130, the British heavy bomber. The 850 hp Gnôme-Rhône 14 Krsd radials are mounted in nacelles between the wings and are equipped with Ratier three-bladed propellers. Empty weight is 17,670 lbs., maximum speed 150 mph and range 1120 miles. Climb to an altitude of 10,000 ft. is accomplished in 16 minutes.

The Loiré-et-Olivier Le 0-259 is an equal span twin-engined bombing torpedo-carrying and reconnaissance seaplane of the twin-float type. Wing structure consists of two rectangular tubular spars, built up girder-ribs, tubular compression struts, and fabric covering. The fabric-covered fuselage is of built up square dural tube assembled with flat plate fittings. The twin floats are of the single step type mounted by *N* struts below each engine nacelle. The fuselage incorporates space for a crew of four and is of similar design to the multi-place fighter-bomber-reconnaissance land plane. In the upper portion of the bow is a special Le. O. rotating enclosed gun turret and below, the bomber's position with transparent panels as in the Breguet 460-M5. Aft are further defensive gun positions each mounting twin guns above and below the fuselage. Bombs and the torpedo are slung between floats under the fuselage.

Engines from 500 to 800 hp may be installed although the service type is usually equipped with the 860 hp 12 Ybrs twelve-cylinder Vee and employs electrically-controlled three-bladed propellers. Maximum speed is 161 mph at 11,000 ft., maximum range 1,150 miles, and empty weight 10,550 lbs.

The Potez 452 is a two-place single engined high-wing braced folding monoplane used as a reconnaissance shipboard flying boat. Wing is of fabric-covered spruce and plywood construction, consisting of two spars and spruce ribs internally braced with metal tubes and wire. Handley Page automatic slots are fitted to the leading edge. The hull is of the two-step type of wood construction specially strengthened for catapulting. Wing tip floats also are of wood and fold back with the wings. A 350 hp Hispano-Suiza 9 Qd, nine cylinder radial engine is mounted in a nacelle projecting forward of the wing and attached to and supported by twin *N* struts fastened to the hull. Pilot and observer cockpits are in tandem directly aft of the wing cutout and are semi-enclosed by a folding windshield. One machine gun is carried aft along with complete radio and photographic equipment. Wing span is 42′ 7.5″ which reduces to 17′ 7″ when the wings are folded. Maximum speed is 138 mph at 7,000 ft., range approximately 310 miles and absolute ceiling 31,320 ft.

An unusual type of shipboard observation seaplane is the twin float, three-place Levasseur P.L. 200. The fuselage is short and rectangular and terminates abruptly aft of the wings. The tail is supported by two fins which are extensions of the twin floats. Rudders are hinged to the float tail posts and are below the horizontal tail plane and stabilizer. Floats are of all-metal construction of the single step type and are strengthened for catapulting. The pilot sits forward and above the leading edge of the wing which is placed high in the fuselage. Navigator-bomber position is below the wing, amidships, with side windows and apertures in floor and roof. The gunner-radio operator, who sits aft in the fuselage slightly below the trailing edge of the wing, is provided with a Scarff mount with twin Lewis machine guns which have an unusually wide angle of fire due to the position of the rudders. Maximum speed is estimated at 143 mph. Weight empty is 6550 lbs. Power is supplied by a 750 hp 9 Vbrs engine.

The general trend towards multi-engined military and commercial planes is pronounced in France. A glance at the accompanying table of French commercial transports shows that even six-place airliners are being equipped with two power plants. Similarly, all heavy fighters of the multi-purpose class are bi-motored and capable of flight on one engine in an emergency. These fighters can perform a variety of duties and best exemplify the French trend towards a combination of functions in a single type. This trend is also apparent in the development of naval aircraft which are designed to carry out a multiplicity of duties. As a result it is almost impossible to point out a pure type of military or naval plane, the only exceptions being the single seat fighter and the night bomber.

The use of the *moteur-canon* is widespread in all types of French military aircraft. This weapon, which originated in France during the World War, is now so developed that it is highly probable that no fighter or bomber within a few years will be without at least one. Its value, at present, is limited by the weight of the shell which makes it impossible to carry more than 60 to 70 pounds per gun. However, its use in breaking up (from a safe distance) formations of bombers and the effect of a combination of several machine guns of light calibre in conjunction with the heavier cannon, has more than convinced French authorities not only of its importance, but also of the predominant and perhaps decisive part it will play in a future war as a defence against all types of aircraft.

French aircraft design leans toward the monoplane with enclosed turrets for machine gunners, fully retractable landing gear, and monocoque construction, although the tendency to cut away the aft portion of the fuselage to increase rear gunner's vision and angle of fire is still apparent. This is carried to the extreme in the Levasseur P.L. 200.

In wing design the most unusual development perhaps is the quickly detachable leading (and in some cases the trailing) edge, for inspection purposes.

Acknowledgment is made to *The Aeroplane*, *L'Aeronautique*, and *L'Aerophile* for the illustrations with this article.

Loire Le 0-259

The Breguet "Bizerte"

Potez 452 shipboard flying boat

1000 hp Wright Cyclone

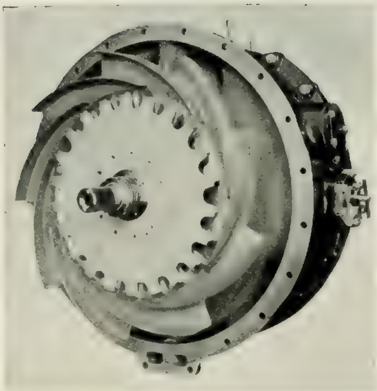
● Wright Cyclone R-1820-G series engines, capable of delivering 1000 hp at take off, are now available for domestic and export use. Attention has been focused on this engine recently as much because of its ability to deliver 1000 hp as because it has powered the planes involved in record-breaking flights by Howard Hughes and Brig. Gen. F. M. Andrews, because it will be used in the new Douglas and Boeing bombers being produced for the U. S. Army Air Corps, and because the newest DST flagships of American Airlines have standardized on it for their power supply.

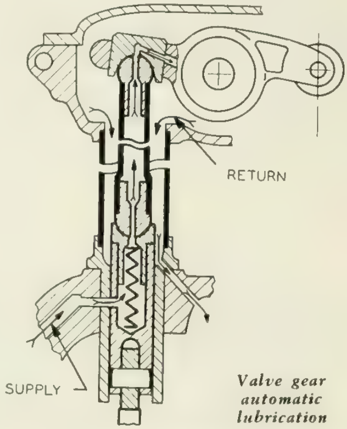
Among features of the new engine are low weight/power ratio and low fuel consumption—the latter being .43 lb./bhp/hr. while certain advanced Cyclone models are down to 1.07 lbs./hp—thus providing longer cruising ranges, lower operating costs, and greater payloads.

G Series Cyclone improvements include a new type of cylinder head with exceptionally closely-spaced cooling fins, automatic lubrication of the valve gear through a built-in system, new type finned spark plug, full pressure baffling, forged pistons, and a simplified and easily accessible accessory system provided with drives to meet requirements of modern military and transport service. In addition, oil sealing has been improved and use is continued of the dynamic damper.

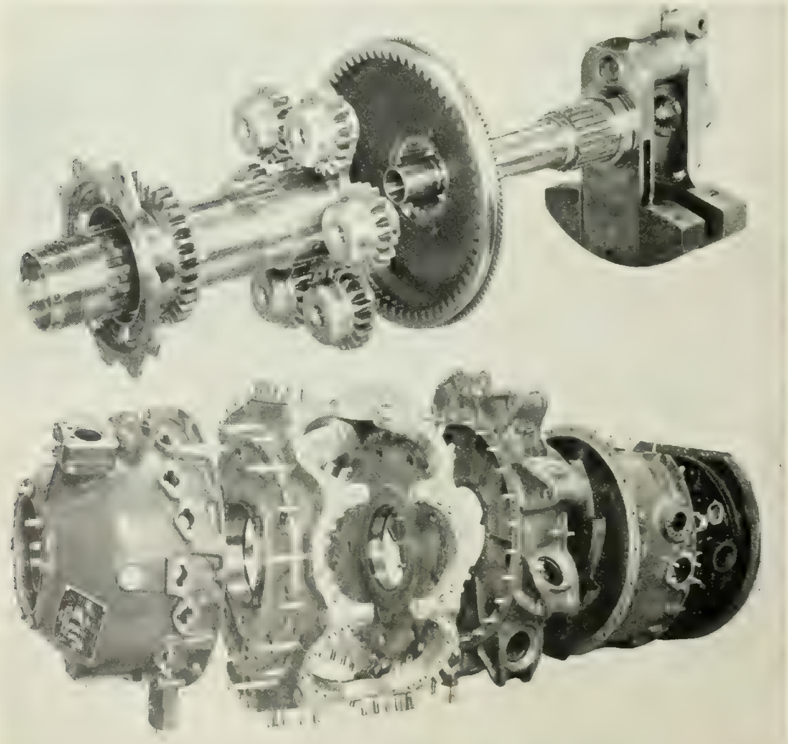
Crankcase of the G Series Cyclone is a five-sectioned unit of similar design and arrangement to the previous F Series, but with modifications to provide increased strength to withstand the higher output.

The main section carries the cylinder foundations. It is forged in two symmetrical parts, of aluminum alloy, and joined in the plane of the center line of the cylinders by nine through-bolts. Main crankshaft bearings and the cam drive gear assembly are carried in this section.


Supercharger unit



Valve gear automatic lubrication


Wright Cyclone G crankshaft assembly and crankcase sections

The nose section encloses the cam mechanism; the valve tappets and their guides; the crankshaft thrust bearings; and, in the case of the geared engine, the reduction gear. Also in this section are the drilled oil passages for lubrication of the valve gear, and the governor for constant speed propellers.

Immediately behind the main section is the mounting section. Nine equally spaced mounting lugs are cast integral with this section to provide for attachment to the airplane engine mounting ring. This section forms the front wall of the supercharger diffuser and distribution chamber and carries the tangential ports for the induction pipes leading to the cylinders.

Supercharger section carries the supercharger vanes and rear diffuser, the carburetor, and mounting pads for tachometer and fuel pump, gun synchronizers and the Cuno oil filter. It acts as a housing for the accessory drive gears, whose bearings are carried on the accessory section.

The accessory section is an approximately flat plate of magnesium alloy which forms the rear crankcase cover. Accessory drive gears, mounted on the forward side of this section, are enclosed in the rear part of the supercharger section, which is separated from the diffuser chamber by an integral wall.

Crankshaft is of the single throw type, constructed from two chrome nickel steel forgings clamped rigidly together at the rear crankcheek, and supported on three bearings. Attached to the rear crankcheek is the dynamic damper which is effective in providing smooth operation and counteracting torsional vibration at all crankshaft speeds.

New cylinder heads have a total effective cooling area of approximately 2800 $in.^2$ per cylinder. Attention has been given

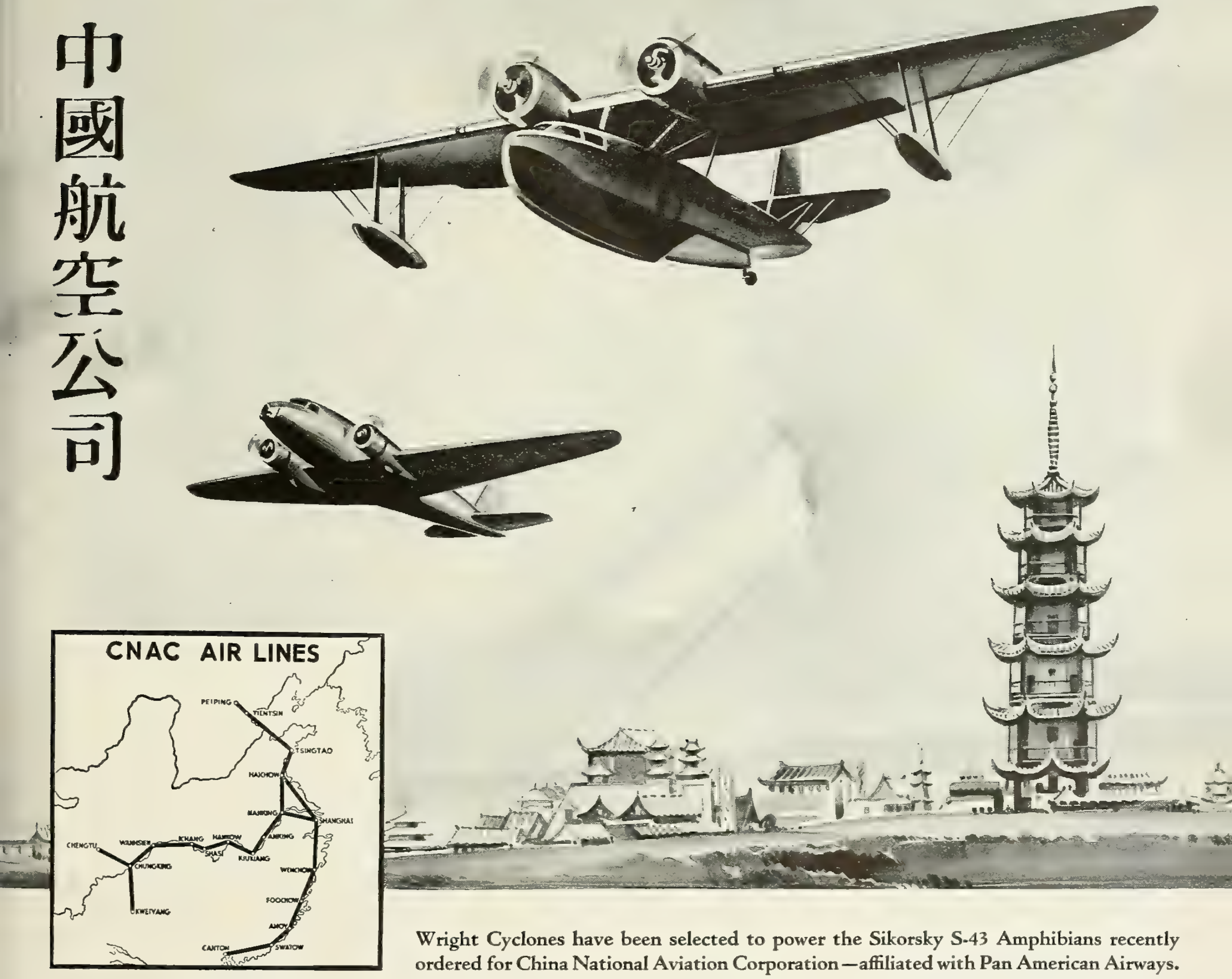
(*Continued on page* 35)

CHINA NATIONAL AIRWAYS'

NEW EQUIPMENT *powered by*

WRIGHT CYCLONES

中國航空公司



Air Line Routes of
China National Aviation Corporation

Wright Cyclones have been selected to power the Sikorsky S-43 Amphibians recently ordered for China National Aviation Corporation—affiliated with Pan American Airways. The Sikorsky S-43 powered by two Cyclones—with a capacity of fifteen passengers and two pilots—combines the world's fastest commercial twin-engine amphibian with the world's outstanding transport engine—the Wright Cyclone.

Cyclone-powered Douglas DC-2 Airliners, now in service on the national airways of China, have revolutionized travel in the Far East. Travel between such important cities as Shanghai and Peiping has been cut from 43 hours by train to 6 hours by plane. Other time savings by plane are as great as 24 days over ordinary travel methods.

China National Aviation Corporation selected Wright Cyclones because of their proven record of dependable performance and economical operation on leading air lines throughout the world.

WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

Gas and oil lines are the operating arteries of the ship. Resistance to fatigue and resistance to corrosion are prime requisites of tubing for long and trouble-free service.

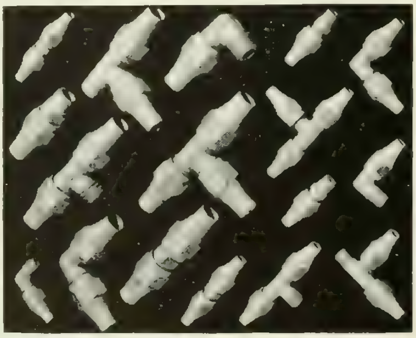
These important characteristics are combined to a marked degree in newly developed Aluminum alloy tubing recommended for this purpose.

The aircraft operator may achieve measurable economies by taking advantage of fundamental improvements which strike at the root of possible service difficulties. By standardizing on tubing of this new alloy the aircraft manufacturer as well as the aircraft operator can effect further economies.

Tubing of this new alloy is regularly furnished in the annealed temper for not only gas and oil lines but instrument lines as well. Only one stock of tubing need be carried.

Following a long period of development and test in both laboratory and factory, this tubing is now in use by several manufacturers and operators.

To manufacturers and operators we will gladly send data on this new tubing, a fundamental alloy development which is a part of our service to the industry. ALUMINUM COMPANY OF AMERICA, 2194 Gulf Building, Pittsburgh, Pennsylvania.



Several manufacturers offer well-designed and accepted fittings for Alcoa Aluminum tubing. Illustrated is the SAE type, forged from Alcoa Aluminum.

ALCOA · ALUMINUM

(*Continued from page* 32)

to distribution of the fins to provide uniform cooling over the entire combustion chamber including the spark plug bosses and the exhaust valve seat, and fins have been carried high up on both the intake and exhaust valve regions. Improved air deflectors are provided to give a more effective use of cooling air and increase the velocity of air flow over the cooling fins. Closer fitting of air baffles has reduced the total area of the cooling air passages approximately 35% to give a present total area of 1.6 ft.^{2}

Control of spark plug temperature has been provided by a new type finned spark plug which has longer threads, greater heat dissipation areas and improved electrical construction.

Intake and exhaust ports are located at the rear of the cylinder head and valves, valve springs, and valve rocker arms are completely enclosed in supporting boxes cast integrally with the head. The valve is continuously lubricated by an automatic lubricating system supplied by the main engine lubricating system. Redesign of the induction passages to the intake valve has reduced resistance to gas flow with corresponding improvement in the mechanical efficiency of the engine as a whole.

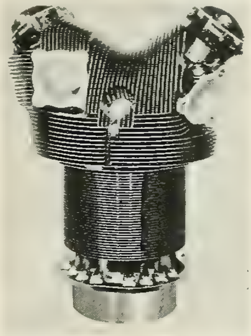
Cylinder assembly is built up of forged nitralloy cylinder barrels, screwed and shrunk into the cast aluminum alloy cylinder head. Internal surfaces of the cylinder barrels are nitrided to a glass-hard surface case.

Exhaust and intake valves are forged from heat resisting steels, exhaust valves being sodium cooled and faced with stellite acting against stainless steel seats, to resist deterioration at high temperatures and the action of lead compounds in combustion.

Valves are actuated by a cam housed in the crankcase nose section. Hardened steel cam follower rollers, running on the cam ring, operate the rocker arms through fully enclosed push rods of seamless steel tubing. Rocker arms are carried on Timken tapered roller bearings.

Valve gear is automatically lubricated from the main oil supply through a built-in system with no external lines. Above the horizontal centerline cylinders are lubricated under pressure through the valve tappets and push rods in which oil passages are drilled. Surplus oil is returned to the crankcase through the passages between the push rods and their housings. Cylinders below the centerline of the engine are lubricated by gravity.

One of the R-1820-G cylinders



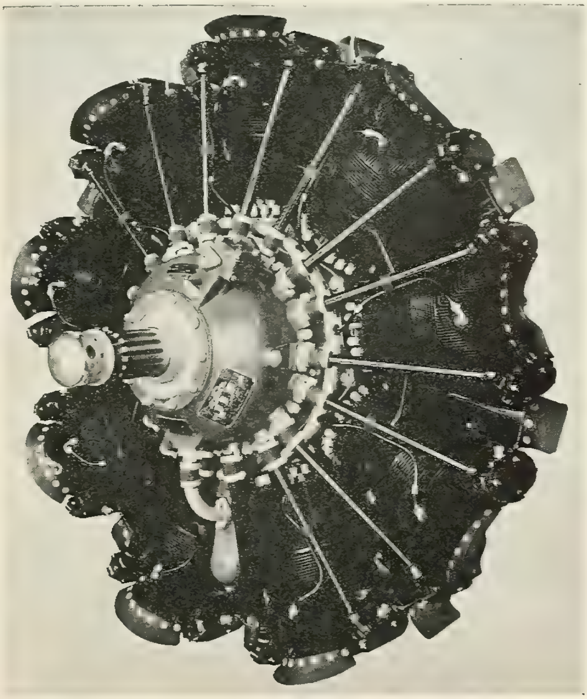
Pistons are aluminum alloy forgings, cross ribbed on the under side of the head to provide strength and to help to conduct heat away from the head to the skirt of the piston. Oil spray striking the cross ribs likewise aids in cooling. Piston skirt has been lengthened to provide improved bearing surface and eliminate tendency of piston rocking in the cylinder.

Connecting rods are alloy steel forgings. Assembly consists of a one-piece master rod and eight articulated rods. Greater strength and stiffness has been provided in the master rod through equalization of stresses at the increased output.

Supercharger of the G Cyclone retains the general form which has been used on the F Series Cyclone except that the area of the inlet has been enlarged to correspond to larger carburetor throat areas and increased capacity of the engine. Refinements in contours and increases in dimensions of diffuser vanes and passages improve capacity and efficiency.

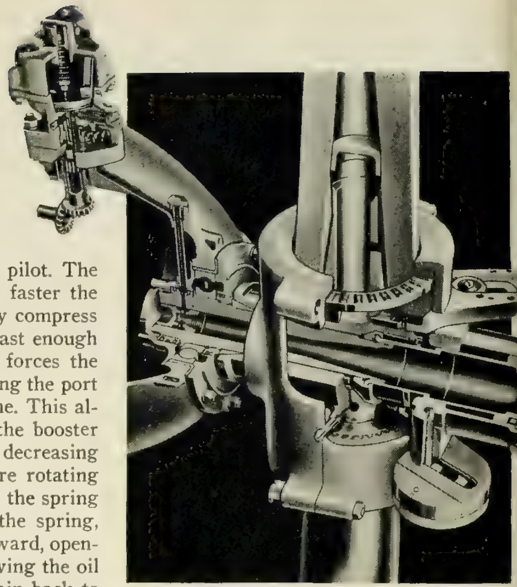
Six optional impeller speed ratios are available, ranging from 5.95 to 10 times crankshaft speed.

Full pressure lubrication is provided to the main bearings by a gear type pump. An adjustable relief valve automatically maintains uniform oil pressure and by-passes excess oil to the inlet line. Oil from all parts of the engine drains to a sump between the bottom cylinders and is scavenged by a gear type pump.



Rear and front views of the new 1000 horsepower Wright Cyclone R-1820-G

Operating Principles of the Constant Speed Propeller



● Constant speed propellers permitting aircraft engines to run at desired rpm regardless of altitude or forward speed of the airplane are becoming an increasingly important feature for engine operation, since power depends both on rpm and throttle opening. The device, which provides engine-speed control independent of the throttle, serves dual purposes, acting not only as a governor to hold rpm constant regardless of the plane's attitude, but also as a controllable load, thus permitting the engine to develop as much of its full rated power as is desired by the pilot. This is accomplished by change of propeller pitch.

In the Hamilton Standard design, pitch is shifted by oil pressure, the propeller being basically identical to the Hamilton Standard two-position controllable. Counterweights actuated by centrifugal force provide the operating mechanism to move the blades toward high pitch, the oil pressure working in the opposite direction against the counterweights and setting the pitch to any intermediate position between full low and full high.

Pitch is automatically selected by a separate unit, the constant speed control, which regulates oil pressure in the propeller-operating cylinder. A gear pump in this unit boosts engine oil pressure up to 180-200 lbs./in.^{2} where it is maintained by a relief valve. Although considerably less pressure is normally required to shift pitch, this comparatively high value gives responsive pitch-changing action when called for by the constant speed control; it also provides more positive governing, eliminating over-revving and under-revving which might result from sluggish action.

In the speed control a pilot valve moves up and down in a cylinder in response to the action of fly weights working against the tension of the rpm spring. These weights are driven by the engine in proportion to engine speed, the tension of the spring being controlled by the pilot. The greater the spring tension, the faster the weights must rotate before they compress the spring. When not rotating fast enough to accomplish this, the spring forces the pilot valve downward, uncovering the port leading to the propeller feed line. This allows oil under pressure from the booster pump to flow to the propeller, decreasing its pitch. When the weights are rotating faster than the speed for which the spring tension is set, they compress the spring, thus carrying the pilot valve upward, opening the propeller port and allowing the oil in the propeller cylinder to drain back to the engine. This shifts the propeller toward high pitch. "On speed" condition results when th erotation of the weights is just sufficient to balance the spring tension and hold the pilot valve so that it closes the propeller port, pitch remaining constant to give the stabilized condition which results in the desired rpm.

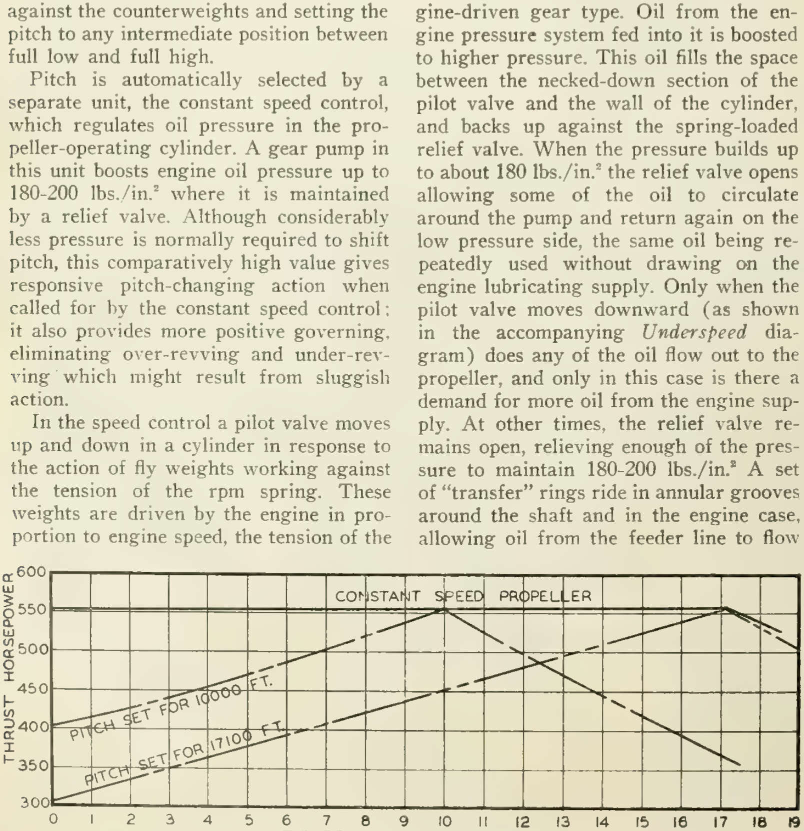
The booster pump is of the simple engine-driven gear type. Oil from the engine pressure system fed into it is boosted to higher pressure. This oil fills the space between the necked-down section of the pilot valve and the wall of the cylinder, and backs up against the spring-loaded relief valve. When the pressure builds up to about 180 lbs./in.^{2} the relief valve opens allowing some of the oil to circulate around the pump and return again on the low pressure side, the same oil being repeatedly used without drawing on the engine lubricating supply. Only when the pilot valve moves downward (as shown in the accompanying *Underspeed* diagram) does any of the oil flow out to the propeller, and only in this case is there a demand for more oil from the engine supply. At other times, the relief valve remains open, relieving enough of the pressure to maintain 180-200 lbs./in.^{2} A set of "transfer" rings ride in annular grooves around the shaft and in the engine case, allowing oil from the feeder line to flow into the hollow shaft and vice versa, and at the same time sealing it from leaking out into the engine.

Hamilton Standard controllables can be converted into constant speed propellers by installing a constant speed control on the engine and by converting the propeller to greater pitch range, if necessary. In some cases minor parts must be changed, but in every instance the conversion can be accomplished as a field modification.

Operating characteristics of constant speed propellers require a departure from the conventional method of manual mixture adjustment. Any increase or decrease of power obtained by adjusting the carburetor fuel/air ratio is accompanied by a change of propeller pitch such that rpm is not affected. Tachometer indications, therefore, cannot be depended upon as with fixed pitch propellers; instead it is customary to use automatic mixture controls or fuel/air ratio indicators such as exhaust gas analyzers and fuel flow meters.

The pilot can discontinue governing action at will and shift the propeller into full high pitch, but except for checking the pitch-changing action or the engine operation there is no point in discontinuing this action with power on. Positive high pitch is important in case of engine failure on a multi-engine airplane, since performance of the plane with one engine out can be improved by shifting the dead engine's propeller to full high pitch where its windmilling drag is much less than in low pitch. Without this feature the dead engine's propeller would automatically be shifted to full low pitch by the constant speed control adjusted to maintain rpm.

Benefits derived from constant speed propellers are most apparent in high performance airplanes, particularly those equipped with supercharged engines. For high speed, especially when reduction gearing is used, comparatively high pitch



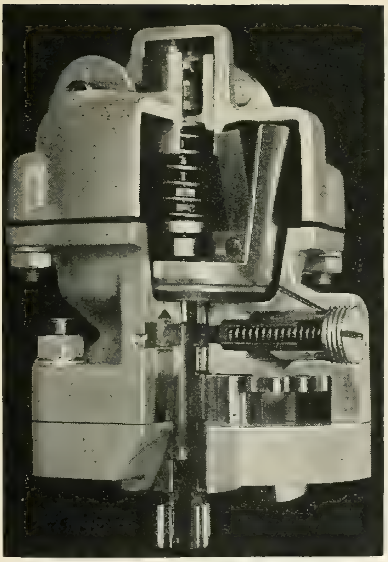
Thrust hp available in level flight with different types of propellers settings are required; yet low pitch settings are needed during take-off. Therefore the range between low and high pitch for these planes is large and it becomes increasingly difficult for the two-position controllable propeller to provide satisfactory performance at all times.

The accompanying graph shows the thrust hp available in level flight at cruising manifold pressure with a fixed-pitch propeller, a two-pitch controllable propeller and a constant speed propeller on a representative high performance airplane which has a maximum speed of 250 mph at 10,000 ft., and an engine delivering 750 hp at 10,000 ft. at 1667 rpm (propeller) with cruising operating limits of 563 hp and 1513 rpm. The propeller used was a three-bladed 10-ft. unit.

The lowest line shows how difficult it would be for the plane to take off with a fixed-pitch propeller under these conditions and therefore, a two-position controllable would probably be necessary, in which case this line would apply to the controllable in high pitch set for 17,100 ft. The low pitch would be set to permit satisfactory take-off and climb at low altitudes. This line shows that with the propeller in high pitch only slightly more than 300 thrust hp is available at sea level, and maximum cruising hp cannot be utilized until 17,100 ft. is reached.

The intermediate line (pitch set for 10,000 ft.) shows the availability of considerably more power at sea level than in the previous case and therefore it would probably be possible to take off with a fixed pitch propeller. However, a two-position controllable with high pitch adjusted to 10,000 ft. and low pitch for take-off and climb would be preferable. Whereas the two-position controllable would provide better airplane performance from sea level to 10,000 ft., it would have no advantage over the fixed pitch propeller above that altitude.

The third line (constant speed control) shows that maximum allowable cruising power can be utilized at all altitudes from sea level up to 17,100 ft. With this propeller 18.6% more power is available at sea level than with the propeller set for 10,000 ft. (a fixed-pitch, or a two-position controllable in high pitch). Likewise with the constant speed propeller, 24.4% more power is available at sea level than with the propeller set for 17,100 ft. (the high pitch setting of a two-position controllable). At 17,100 ft. (critical engine altitude for cruising power) the constant speed propeller cannot make available more power than the high pitch setting of the two-position controllable, but as compared with the fixed pitch propeller set for 10,000 ft. (or the high pitch of a two-position controllable set for 10,000 ft.) there is 43.5% more power.



Cut-away view of the governor unit for the constant speed propeller

For the take-off the pilot may utilize all of the power which the engine manufacturer allows for its safe operation by opening the throttle to give maximum permissible manifold pressure at the blocks and adjusting the constant speed control to give full take-off rpm. The constant speed propeller will hold and utilize this rpm constant irrespective of the change in the forward speed of the plane as it increases from zero at the start of the take-off to flying speed.

While climbing to cruising altitude the full rated power of the engine is available at all flying speeds and all altitudes by independent control of the manifold pressure (throttle) and the rpm (constant speed control). With supercharged engines there is a decided increase in the rate of climb to cruising altitude compared with performance using a fixed pitch or a two-position controllable propeller.

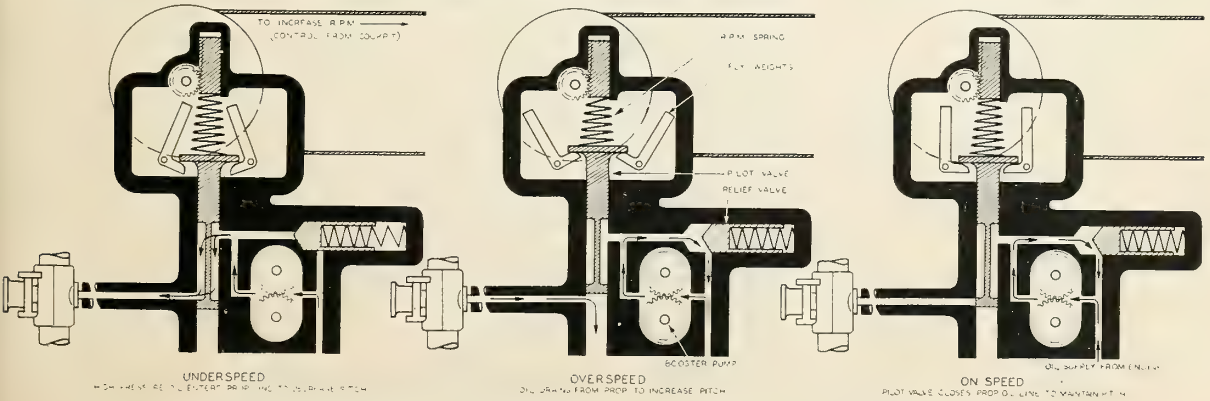
When cruising altitude is reached and the pilot wishes to reduce power for cruising, the constant speed control is set to the corresponding rpm and the throttle adjusted to cruising manifold pressure. Change in altitude necessitates readjustment of the throttle to correct for the corresponding change in manifold pressure, but the rpm will remain unchanged, being automatically compensated for by the constant speed control.

Cruising and maximum speeds are both improved above and below critical altitude for cruising compared with performance when using a fixed pitch or two-position propeller. At critical altitude the constant speed propeller gives the same performance as either a fixed pitch or a two-position controllable adjusted for that altitude, but above that altitude there is improvement in cruising and maximum speeds.

In military airplanes the constant speed propeller is valuable in providing full engine power under all conditions of fighting maneuvers, eliminating effects of engine overspeeding incident to diving. In formation flying the speed of each airplane is controlled by throttle in the conventional manner, but this change of power is not accomplished by a corresponding change of rpm since this is held constant. Only the manifold pressure is changed. The constant speed propeller also allows various aerobatic maneuvers without readjustment of the throttle.

On multi-engine airplanes the degree to which the rpm of the engines can be held constant is more exacting than in

(*Continued on page* 84)



UNDERSPEED
HIGH PRESSURE OIL ENTERS PROP LINE TO DECREASE PITCH

OVERSPEED
OIL DRAINS FROM PROP TO INCREASE PITCH

ON SPEED
PILOT VALVE CLOSES PROP OIL LINE TO MAINTAIN PITCH

Diagrams illustrating the operation of the Hamilton Standard constant speed propeller governor unit

An Engine-Propeller Chart
As a Practical Aid to Calculations

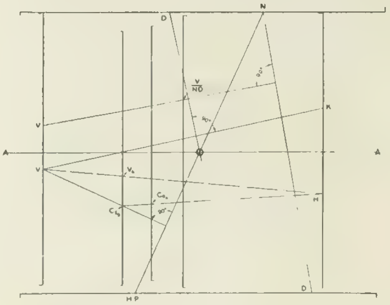
W. F. EADE

● Performance calculations for an airplane are admittedly laborious and any expedient that will produce satisfactory results quickly is worth while, provided the expedient is not costly. The accompanying chart provides the means to determine several basic factors quickly, and these can be followed up with the final calculations, which can be made part of the permanent record for the files by simply drawing the lines of intersection on the chart. Tabulations are thereby minimized.

Six equations are given in chart form, from which the basic data can be obtained. The propeller diameter is determined from the equation

$$D = K\sqrt[4]{\text{hp}/VN^2}$$

For the purpose of simplicity, values of K are indicated on the scale for two- and three-bladed metal propellers. The range in values of K on the scale is broad enough to cover all possible types. It must be remembered that usually the engine has been specified and this means that the engine speed is defined. When the designer is given the choice of an engine there exists a certain amount of latitude, and the engine speed, propeller diameter and number of blades can be determined for best all-around results.



FORMULAE

1 $C_{s_0} = \dfrac{0.638V}{HP^2N^4}$

2 $D = K\sqrt[4]{\dfrac{HP}{VN^2}}$

3. $F = \dfrac{88V}{ND}$

4 $C_{s_h} = C_{s_0}\left(\dfrac{\rho_0}{\rho}\right)^2$

5. $V_h = V_0\left(\dfrac{\rho_0}{\rho}\right)^5$

6 $T_s = \dfrac{\pi ND}{60}$

LEGEND

V = VELOCITY in M P H

C = SPEED POWER COEFFICIENT

H P = BRAKE HORSE-POWER

N = REVOLUTIONS of ENGINE per MINUTE

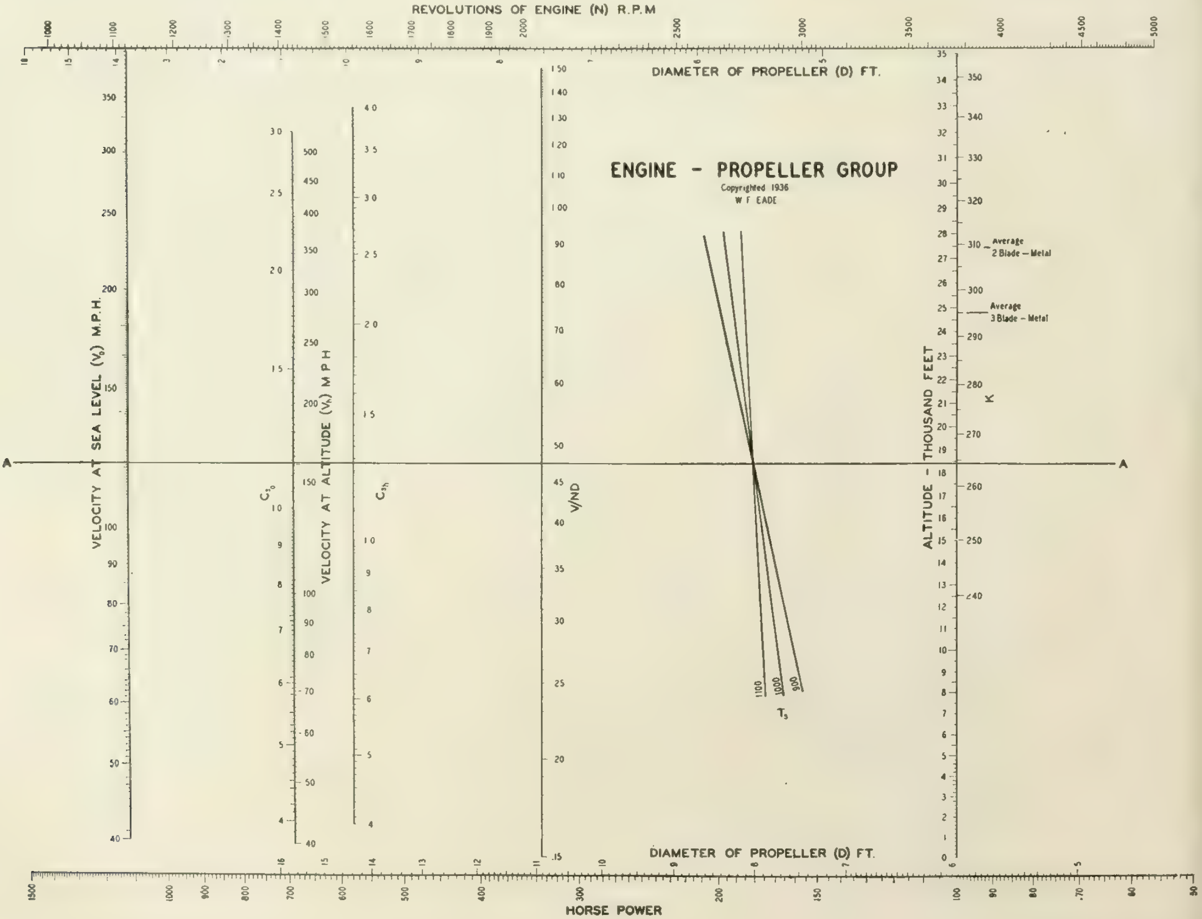
D = DIAMETER of PROPELLER in FEET

$\frac{\rho_0}{\rho}$ = RECIPROCAL of DENSITY RATIO

K = PERFORMANCE FACTOR (PROPELLER)

T_s = PROPELLER TIP SPEED (FT/SEC)

Assuming the engine is decided upon, the propeller diameter and number of blades can then be determined. It would be well to note that the largest diameter two-bladed propeller commensurate with other factors in the airplane design will be the most efficient. Should this diameter (operating at the given engine speed) give a tip speed too close to or above 1000 ft./sec., it will be necessary to resort to three blades operated at the given engine speed. A simple method is provided on the chart (see radial lines marked 900, 1000 and 1100 T_s) to indicate the proximity of the calculated tip speed to 1000 ft./sec. Lieut. Comdr. Diehl, of the Bureau of Aeronautics, U. S. Navy, concurs with the author in that this method of checking tip speed is satisfactory. The check is simple to make in that any values of N and D aligned on the chart for a specific case can be compared to these slopes. and basic alterations made if



this is found to be necessary.

Having decided upon the propeller diameter to operate at the given speed, the next two steps are to determine values of C_{so} and V/ND for the required speed range. The equations providing these values are

$C_{so} = 0.638V/\text{hp}^{.2}N^{.4}$ and $F = 88V/ND$

The key diagram accompanying this chart indicates the procedure to solve all equations given. Following the key diagram, it is simpler to arrive at consecutive answers to equations 1 and 3 by using a 90° chart arrangement. To illustrate: a rule placed on the chart to connect hp and N provides a base against which the triangle may slide vertically, intersecting C_s values for required speed intervals. In doing this, lines may be drawn on the chart to give a permanent record which can be referred to at any time.

Determining V/ND

The same system is used to determine V/ND, that is by connecting N with D as determined by equation 2 and again drawing lines from the speed intervals, crossing at F or V/ND scale, again providing a permanent record. With these two determinations (C_s and V/ND) recourse must be made to NACA Technical Report 350 for propeller efficiencies and blade angles before final performance calculations can be made.

Many of the engines used today are supercharged for specific altitudes. This necessitates making performance computations for this altitude, and to facilitate this work there is included the additional scales C_{sh}, V_h, and altitude in thousand feet. Having obtained values of C_s, V/ND for both sea level and altitude, the next step involves use of TR 350 to determine efficiencies and blade angles.

It is suggested that while looking up blade angles and efficiencies, the values so found be written on the chart.

Sample calculations for the first five equations are given here, the sixth being an adjunct and requiring no further explanation.

Sample Calculations

Equation 1: Connect $N = 2000$, with hp $= 500$; 90° to this line intersect $V = 100$ and read $C_{so} = .88$

Equation 2: Connect $V = 100$ and $K = 285$ (3-blade, metal); at 90° to this line draw another through the intersection of $N = 2000$ and hp $= 500$ with the line A-A to the upper D scale; read 9.85 ft.

Equation 3: Connect $N = 2000$, with $D = 9.85$ (bottom scale) with rule, slide triangle along rule and read $F(V/ND) = .67$ when $V = 150$.

Equation 4: Connect C_{so} (.67) with altitude $=$ 15,000 ft. and read $C_{sh} = .96$

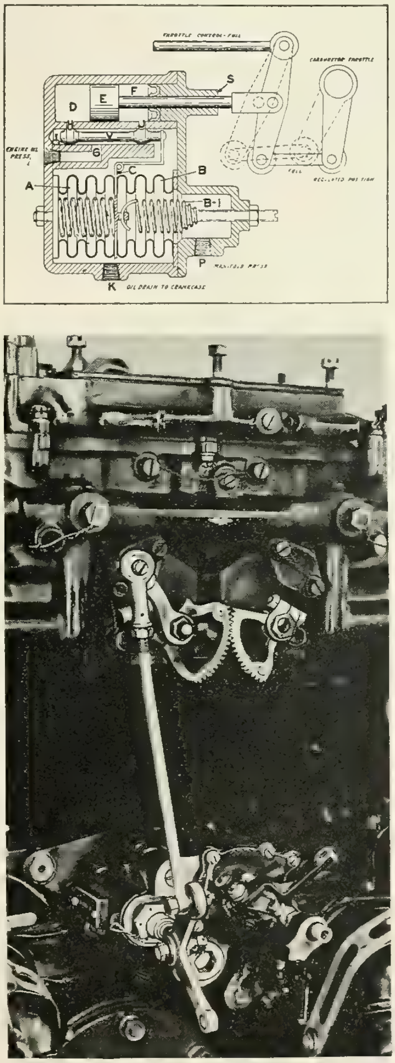
Equation 5: Connect $V_o = 100$ with altitude $=$ 15,000 ft. and read $V_h = 93.6$

Supercharger Pressure Regulator

● Manual operation of the throttle to keep close control over intake manifold boost or supercharger pressure on modern aircraft engines has been eliminated by the development of a 3.5 lb. two-position supercharger pressure regulator.

Perfected by Eclipse Aviation Corp., with the assistance of Wright Aeronautical Corp. engineers for Wright Cyclone engines, the new unit, by automatically regulating the throttle, limits manifold pressure to the allowable boost at take-off and in cruising, regardless of change in engine speed or altitude.

The regulator automatically maintains maximum boost at take-off and limits boost at cruising or rated power depending upon the desired conditions through an engine oil actuated servo piston, controlled through two sylphons by the intake manifold pressure. The shift from one position to the other is made by moving a selector lever in the pilot's compartment. The oil operated servo piston moves the throttle to maintain the desired pressure without any movement of the pilot's throttle control due to the action of the linkage.



Installation and diagram of the Eclipse pressure regulator

The two sylphons (the heart of the device) or metal bellows, are shown at A and B in the accompanying diagram. Sylphon A is evacuated. To offset the accompanying loss in internal atmospheric pressure, a compression spring is provided in A. In the opposite bellows, which is connected with the intake manifold, is an adjustable spring to give a definite amount of tension on the evacuated bellows. This spring is attached to diaphragm C.

Through adjustment of the tension of this spring, the unit may be made to regulate to higher or lower absolute manifold pressures within a range of 25" to 40" Hg. abs. The absolute pressure reference in this device is the evacuated bellows.

Operation of the regulator is simple. At the take-off, the pilot sets the selector lever at the "Take-Off" position and shoves the throttle full open. Suppose, for example, as is normally the case, the manifold pressure at full throttle on the ground is above the limit set for which the regulator is adjusted. The tension spring *B-1* is unable to offset the pressure communicated through P to the sylphon B, with the result that B expands to the left, carrying the diaphragm C with it. The diaphragm in turn pushes the oil valve V to the left and admits the engine oil under pressure from G through H into the servo piston cylinder D, forcing the servo piston to the right, tending to close the throttle to which its shaft is linked. As soon as the throttle is closed sufficiently to provide the proper manifold pressure, the drop in pressure is communicated to B which contracts to its normal position and permits the oil valve to return to the neutral position shown in the sketch.

Any oil in chamber F behind the servo piston, displaced by the piston in moving toward the right to close the throttle, drains down through J to be returned to the crankcase through the oil drain K provided at the bottom of the housing.

By closing the throttle beyond the point where the servo piston E reaches its inward stop S, the regulator is rendered ineffective and throttle control becomes normal, permitting pilot to operate at supercharger pressures below the regulated pressures.

EDITORIALS

"We are strengthening our defenses to prevent a world war. I do not believe that any country wants a world war, but if I am wrong and there is any country so foolish and criminal, I say to that country that we are re-arming because we are determined to make a world war impossible."—SIR SAMUEL HOARE, First Lord of the British Admiralty.

More Money for More Airplanes

● The U. S. Navy is now engaged in almost doubling its aerial fighting forces to meet requirements of a treaty strength fleet to be achieved by 1942, but it must now cope with shortage of pilots.

To rectify this deplorable situation the Bureau of Aeronautics requested the commanding officers of all ships and stations to forward immediately applications of enlisted men who are physically qualified and temperamentally adapted to become airplane pilots. These men will be trained at Pensacola and will fill an existing shortage which will be further increased to 292 by next July as the result of the commissioning of the new aircraft carriers *Yorktown* and *Enterprise,* four cruisers, and the organization of new squadrons for the fleet.

There are now about 1311 serviceable planes in the Naval service and recently contracts were let for 114 torpedo-bombers to operate from the new carriers. The 1942 aim is 1910 planes to equip all ships.

Congress has approved a bill calling for 4000 planes for the Army in the next five years. But that is as far as it has gone. The necessary appropriations to purchase these planes have never been put aside.

Our Army Air Corps is too fine a group to be tricked by the shell game of political sleight-of-hand. These planes are needed now and every effort should be made to get them for the army, even though it means diverting some funds from some of the WPA, PWA and other alphabetical projects which are being foisted on the people for no other purpose than to get sorely-needed votes in the coming election.

The Passing of Two Pioneers

● Louis Bleriot and Earle L. Ovington—beloved and well-known pioneers whose innumerable flying exploits helped cement the foundation upon which aviation progress has been built—met their untimely deaths from natural causes.

Bleriot will go down in aeronautical history as the famous airman who on July 25, 1909, first flew the English Channel from France to England and gave impetus to future transoceanic flights.

It was in a monoplane of Bleriot's design that Ovington made the first air mail flight in this country. On September 23, 1911, he made his historic ten-mile flight from Nassau Boulevard to Mineola, Long Island, holding in his lap (for there was no space for baggage) a sack of mail which he dropped to the waiting postal official at the end of his flight. He continued these flights on nine days. It was regarded by the unthinking at the time as a good "stunt" and few persons conceived the tremendous development in communication it heralded. Twenty years after Ovington's brief mail service, tons of U. S. mail were carried day and night over 23,488 miles of established airways.

We who had the privilege of meeting and knowing these men saw the enthusiasm with which they worked, always in the interest of the science in which they believed and for which they risked death by sudden accident. Kind fate spared them to expire peacefully. The industry is founded upon such pioneers as these.

Trail Blazing Over the Arctic

● The Soviet Aviation industry can be justly proud of the achievements of its ground and flight personnel in the difficult flight from the United States to Moscow. Undaunted by the discouraging climax of a previous attempt over approximately the same route (but starting in Moscow) a year ago, the present flight was carried out despite all the dangers and uncertainties still existing in the far north.

We have much to learn in this unexplored region which has claimed the lives of many hardy pilots, including those of such prominence and experience as Wiley Post. A better understanding of Arctic flight conditions and the establishment of a trade route by way of Alaska will result in mutually beneficial relations between Russia and the United States which cannot fail to reflect to the advantage of all those participating wholeheartedly in this pioneering enterprise.

While Soviet aviation has experienced considerable advancement in the past few years, and a Soviet-built and manned plane recently completed the longest and most difficult flight ever undertaken, it is a source of satisfaction to Americans that the latest type of American equipment (a Vultee) was used by the two pilots who recently pioneered the trade route from Los Angeles to Moscow.

All First Class Mail by Air

● In the past few years our transport companies have come a long way—despite artificial handicaps originating in the Post Office Department and as well as needless and abortive investigations by self-styled experts who know nothing about the peculiar problems of the air transport system in this or any other country.

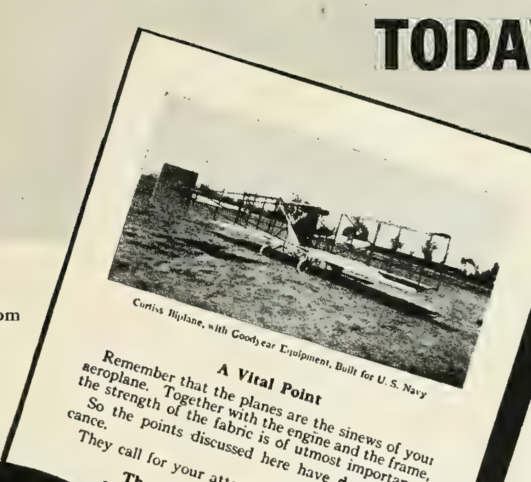
In attaining foremost ranking among the nations of the world in air transportation, American operators have developed flying equipment which is being used as a model for the rest of the world, and ground equipment and blind flying aids which are of material aid in flying practically as many miles as are scheduled. These operators are now flying more miles than ever before, and the possibility of a cancellation because of unflyable weather is so remote as to be practically negligible. United Air Lines, for instance, completed 100 percent of 1,571,522 scheduled miles during July, and 99.9 percent during May, June and July on its transcontinental and Pacific Coast system, showing that diversification of territory is no handicap in the maintenance of proper schedules. American Airlines, too, can point to an exceptionally fine operating record, completing an average of 98.4 percent of its scheduled flights during July. American flew 1,326,824 miles, and maintained 100 percent frequency over its three major routes—Chicago-Ft. Worth, Cleveland-Nashville, and the Southern Transcontinental run.

These operating figures could be applied almost as well to any of the 21 companies now flying scheduled routes in this country.

In the comparatively near future, Great Britain will adopt a policy of carrying its first class mail by air, again leading the way in a pioneering effort which should have been instituted in this country long ago.

Our operators are maintaining as near perfect schedules as is humanly possible and have demonstrated their ability in getting through on schedule over a period long enough to dispel any doubts which may have existed on this score. What excuse is there left for not giving our people all over the country a real first class mail service? In other words, why not "all first class mail by air" NOW?

One of the
PIONEERS in AVIATION
—AND STILL PIONEERING TODAY



Curtiss Biplane, with Goodyear Equipment, Built for U. S. Navy

A Vital Point

Remember that the planes are the sinews of your aeroplane. Together with the engine and the frame, the strength of the fabric is of utmost importance.

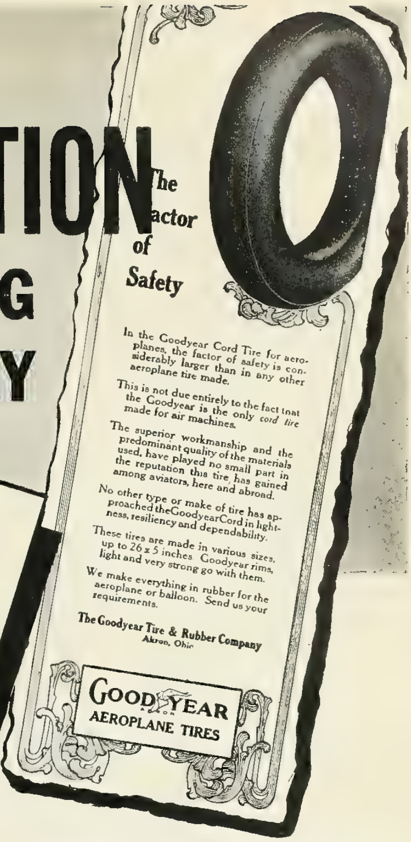
So the points discussed here have deep significance.

They call for your attention.

The U. S. War Department Uses Goodyear Aeroplane Fabric

he Curtiss Aeroplane Company,
ght Company, Burg
Internation

24 years ago—page from Goodyear pamphlet published in 1912.



The Factor of Safety

In the Goodyear Cord Tire for aeroplanes, the factor of safety is considerably larger than in any other aeroplane tire made.

This is not due entirely to the fact tnat the Goodyear is the only *cord tire* made for air machines.

The superior workmanship and the predominant quality of the materials used, have played no small part in the reputation this tire, has gained among aviators, here and abroad.

No other type or make of tire has approached theGoodyearCord in lightness, resiliency and dependability.

These tires are made in various sizes, up to 26 x 5 inches. Goodyear rims, light and very strong go with them.

We make everything in rubber for the aeroplane or balloon. Send us your requirements.

The Goodyear Tire & Rubber Company
Akron, Ohio

GOODYEAR
AKRON
AEROPLANE TIRES

20 years ago—Goodyear advertisement in first aeronautics magazine, August, 1916.

*IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL! AIRWHEEL is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of AIRWHEEL Tires.

IN joining with the aviation world in celebrating the 20th anniversary of commercial flying, Goodyear proudly recalls its own quarter-century of contributions to safer flight which have helped speed man's progress in the air.

As early as 1910 Goodyear was the leading manufacturer of airplane tires, rubber springs, Bleriot type shock absorbers and rubberized "aeroplane" fabric. In the 1911 Chicago Air Meet 90% of the entries used Goodyear products.

That pioneering still goes on at Goodyear as evidenced by the huge, super-soft Airwheel* and Goodyear's quick-stopping, sure-gripping, instant-releasing Airplane Brakes, both hydraulic and pneumatic — latter day developments that add immeasurably to the safety and comfort of today's big swift ships.

In designing and building the super-craft of the future Goodyear is ready to work with you wherever rubber can serve — just as it always has in the past. Write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, Calif.

ON YOUR NEW SHIP SPECIFY GOODYEAR AIRWHEELS AND GOODYEAR AIRPLANE BRAKES

What About Safety in the Air, Mister President?

●

CY CALDWELL

●These are indeed nerve-shattering days for our politicians. Even Father Coughlin collapsed before he had quite finished a campaign speech at Cleveland recently, and had to be supported from the platform—though not by Doctor Townsend.

In such hectic times it is to be expected that the business of running the country must be neglected and the President of the United States is no exception to this rule. For three years he has been running the country—mostly into debt—but this year he has laid aside all interest in his Florida Alligator Bathing Pool, his queer Quoddy tide-tickling experiment, and his various Moscowish alphabetical absurdities, and is devoting every ounce of energy to getting himself reelected. He has tasted Power, he has wallowed in it for over three years, and, with the help of God and Jim Farley, he hopes to continue wallowing for yet another term. So *Der Fuehrer*, hell bent for election, is far too busy to glance over the findings of the Copeland Committee on Safety In Air.

Not that safety or lack of safety in the air is of any personal importance to Dr. Franklin Delano Roosevelt, L.L.D., for he never goes up in the air—except in those moments when he happens to think of the United States Supreme Court. Before his election to the Presidency he did make one trip in an airplane—just one. But on that occasion he was dashing to Chicago to accept the nomination and was in such a frantic haste that the train was much too slow for him. Incidentally, I am happy to deny the rumor that Jim Farley had to lasso, rope, and hog-tie Franklin in order to get him into the plane. He went voluntarily for the publicity. However, he hasn't been up since, so we are correct in assuming that safety in the air is of no personal importance to dear old Uncle Smiley, the Pee-pul's Friend.

Safety is of some importance, though, to the large number of our citizens—some of them Democrats with a vote to deliver—who often use the airlines for their travels. Airlines devote every effort to insure safe operation of their ships. The Copeland Committee in its preliminary report flatly declared that the Bureau of Air Commerce, and not the airline, was to blame for the crash of a TWA plane at Atlanta, Mo., May 6, 1935, in which Senator Bronson M. Cutting, Pilots Bolton and Greeson, and three passengers were killed, and five others severely injured. It placed the blame for unsafe operation of government airways largely on the broad shoulders of two officials, Eugene Vidal, Director of Air Commerce, and Rex Martin, his Assistant Director, in charge of the Air Navigation Division. Neither has as yet been dismissed by President Roosevelt, who appointed them. Possibly the President has been too busy fishing—for fish and votes. If so, it is perhaps in order for a taxpayer to remind the President that we elected him and are paying him a salary to do more than fish. I advise my six readers to vote for Landon, who lives in a typical prairie state where Vincent Astor can't moor his yacht.

A Damning Report

Now, the Senate Committee's report is so damning of Martin and Vidal that I am constrained to believe that Dr. Roosevelt has not troubled himself to read it. If he had, it seems incredible that he would have failed to take action and throw those two Senate-named incompetents out of the long-suffering Bureau. However, in order to help the President more efficiently to discharge his duty to the citizenry, I present here some information from the report, hoping in this way to bring the matter to his attention.

I quote from Volumes 1 and 2 of the Senate Committee Hearings, numbering 1348 pages of fine print, which nobody ever will read in full. These extracts are from pages 1276 to 1304, inclusive, of Vol. 2, an analysis prepared by the Committee from Transport Pilots' constructive suggestions on aids to air navigation, which the Bureau of Air Commerce received in answer to its own questionnaire.

Asked the number of times they had found themselves in a dangerous situation due to failure of Rex Martin's radio range, thirteen pilots of Pennsylvania Air Lines sent in a joint reply: "Average five times per pilot", making 65 times in all that the range had failed. The dangerous positions in which they found themselves were due to "reversal of quadrants, sudden shifting of courses, weak signals, station shut down without notice when pilots were flying on instruments, one side of the station going out." Outside of that, everything was swell!

Asked if the relative reliability of the radio range stations was better or worse now than it was 2 years ago, the 13 unlucky pilots—unlucky because they still have Martin and Vidal to contend with—answered: "Dependability of operation 50 percent worse; stability of courses 50 percent worse." There's progress for you! —and under the so-called progressive New Deal Vidal who has been clamoring for a fool-proof $700 airplane! A pilot certainly needs a fool-proof airplane on Mr. Vidal's hectic radio ranges to protect him from the fools of Bureaucracy. Asked what percentage of radio range courses they found on course as advertised, the 13 pilots replied unanimously, "Zero percent." Volumes could not say more.

How Long Can This Go On?

Now, here are some remarks culled from individual reports of 20 TWA pilots: "Lack of proper maintenance, apparently; believe much equipment satisfactory if properly adjusted and maintained. Fault with aids of Department of Commerce — undependable range operation; radio ranges off the air too much of the time. Radio range courses on course, 75 percent . . . The present location of radio beacons at Camden, Pa., Columbus, and St. Louis, all unsatisfactory for all approaches . . . New Pittsburgh range is bad—an accident will happen soon if present system is continued." (This report was received by the Bureau of Air Commerce *some time before the crash* of a TWA Douglas at Uniontown, Pa., on April 7, 1936, with the deaths of two pilots, ten passengers, and the severe injury of the sole surviving passenger, and the slighter injury of the stewardess. The question inevitably presents itself: Who in the Bureau of Air Commerce are responsible for those deaths?)

Here is another comment on the Pittsburgh range: "This new range is an invention that somebody in the Department of Commerce is trying to force down a pilot's throat—it isn't right. Soon, in icing conditions, this range will lead a pilot off and result in a crash. Why pick on Pittsburgh, of all places? Please investigate by vote the new Pittsburgh range before it's too late." Investigating now, however, will not bring to life the two dead pilots and ten dead passengers, though it may save others.

And here's another TWA pilot com-

(*Continued on following page*)

AT 300 MILES OR 90

At all speeds . . . these Oils give you *Positive Protection*

Here is an airplane lubricant that meets the most grueling requirements of high temperature in any engine built today.

Yet, it is free flowing and gives positive lubrication even at the lowest temperature.

Such performance was not possible until Texaco refining engineers developed a special process for making oils. This process eliminates the harmful impurities and assures a product that is *all lubricant*—free from harmful carbon and sludge forming elements.

These lubricants were not developed specifically for any one type of service. They were made to cover the entire range of airplane requirements and will maintain constant power no matter what type of activity you are engaged in—private flying—commercial operations . . . endurance and altitude tests—and speed.

That is why three out of four leading airlines, after testing well-known airplane oils on the market, have standardized on Texaco Products for their equipment.

A Texaco aviation representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

THE TEXAS COMPANY
135 East 42nd St., New York City

Nation-wide distribution facilities assure prompt delivery

TEXACO
AVIATION PRODUCTS

(*Continued from preceding page*)

menting on the same condition: "Our company has had instances where Pittsburgh had to be passed up as a result of unusable beam in adverse weather conditions. Radio range stations 90 percent reliable, *except from Kansas City and Pittsburgh.* At present *A* and *I* system is practically useless. Reliability much worse than 2 years ago, when experimental stations replaced reliable ones at Kansas City. *Can never depend on Kansas City and Pittsburgh.*" Who is responsible for placing experimental equipment in a dangerous area like Pittsburgh? Has any Bureau of Air Commerce official any personal reason for favoring a certain manufacturer's radio equipment? Those are questions for the committee to find answers to—and possibly for a Grand Jury to consider. Manslaughter is still an indictable offense, even under the New Deal, which has changed so many things, including the National Debt,—but not the effects of a rapidly moving body like an airplane hitting an immovable object, such as a mountain at Uniontown, Pa.

The same pilot continues: "Complaints have had no results in cases of Kansas City and Pittsburgh. Consider present range experiment at Pittsburgh and Kansas City very detrimental aids to air navigation. When on top or on instruments the lives of pilots and passengers are solely dependent on the efficiency of radio ranges. The efficiency of such an important item should never be sacrificed for the purpose of experiment and the resultant endangering of life and property." But efficiency *was* sacrificed, lives were snuffed out, and property destroyed.

Another TWA pilot: "A few days ago we were all over the sky looking for the on-course signals, and I don't want to be doing that in icing conditions. Keep the range free from talking, if possible." God—not the Bureau of Air Commerce—was good to them that day: there was no ice! "Failure of radio range twice has resulted in a dangerous situation."

Another TWA pilot, to the question, "Do you ever completely rely on the Dept. of Commerce reports and facilities," replied cheerfully, "Yea, verily; and in the darkest hour, the beam—she go flooey!" These are indeed troublous times we fly in—but the passengers,—God bless and protect them!—suspect nothing, and sleep calmly. They don't know Vidal and Martin.

"Cutting off the range for weather broadcasts happens frequently when arrival schedules coincide with broadcast periods and is a dangerous proposition, particularly in the latter stages of an instrument approach under conditions of low ceiling and restricted visibility, for it is always necessary to pull back up, and with no beam to give you your quadrant location and with other ships milling around and converging on the same area, such as at Newark and Chicago. One instance at Chicago almost resulted in disaster: five airline ships all arrived over the cone within minutes of each other, on instruments at night. The first across, a UAL Boeing, was instructed to make his instrument approach and was pretty well down when the broadcast came on. All five ships had requested continuous operation of the beam and continued to call for it, while the operator leisurely blatted away about the weather out in Podunk, when the only ships interested in it or out in that kind of weather at that time of night were right over the field, short of gas, and wondering where the others were. The Boeing had to pull up, and the other four ships took compass courses away from the field to await the finish of the broadcast. In the melee out, a TWA Douglas ran right across the top of a Chicago & Southern Stinson, missing it, the pilots told us later, by less than 50 feet, and almost rocking them out of control." This incident, I might add, will not be mentioned in airline advertisements. It has taken more than a year of continuous complaint by airline pilots, and also the spotlight of a Senate investigation, to induce the incompetent and what many pilots call the criminally negligent officials of the Bureau of Air Commerce to rectify this condition—which never should have prevailed.

More Reasons For a Change

Now I shall quote from a large number of replies from transport pilots, some on airlines, some not. Among the airlines are Central, Western Air Express, American, Eastern Air, Wyoming, Pennsylvania, Braniff, and United. Lack of space necessarily limits me to a few, out of hundreds of damning reports. "Nashville, Tenn., range seems unsatisfactory after dark." . . . "Twice at Pittsburgh the failure of the radio range due to bending of and false beams resulted in a dangerous situation." . . . "Failure of radio range five times resulted in dangerous situations. In every instance it required five or more final approaches necessitating in each case at least 40 minutes of extra flying." . . . "Radio range courses on course: 75 percent." . . . "Failure of radio range: Four times resulted in dangerous situation. Beams swing very badly at night." . . . "Radio range courses on course: 60 percent." . . .

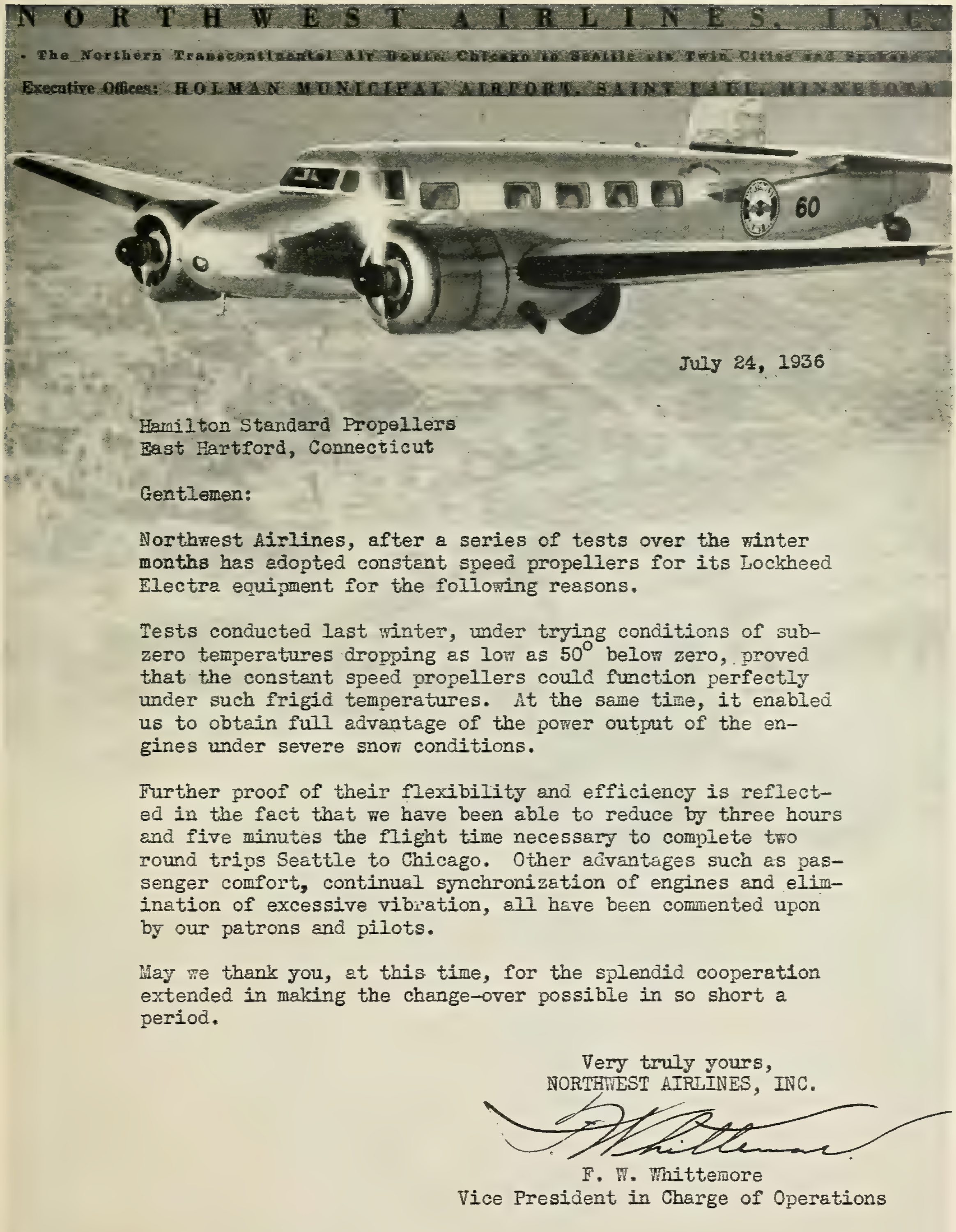
"About half radio ranges on course." . . . "Radio ranges on course: 25 percent." . . . (He must have been flying back and forth over Pittsburgh). "Courses are crooked and swinging badly: on course, 70 percent." . . . "Suggest Dept. of Commerce radio technician ride on some bad weather trips to get actual picture." . . . (But that might unsettle him on radio!) "Elmira, N. Y., is terrible." (Don't let Elmira hear you say that!) "Nashville for years has been useless without any action by Dept. of Commerce." . . . "Radio ranges not reliable; stability of course very poor. Extremely small percentage of ranges on course as advertised. Following range stations so poor in stability and course accuracy as to make them dangerous: Portland, Medford, Shasta, Oakland, Los Angeles, Saugus, and Williams." (Oh, you just lack confidence, that's all!)

"Radio range station at Kansas City has been operating experimentally on the *A* and *I* system, which is not of any value, as a whole device. Impossible to distinguish between *A* and *I* and the on-course. The present medium power such as the one at Kirksville only carries 10 miles. In ships cruising at 80 miles an hour, one has to be within 3 minutes of the station before he can tune in." (This is the station that poor Bolton, pilot of the Cutting plane, was trying to pick up—at 180 miles an hour!)

"Radio range courses on coure 10 percent." (My dear fellow, you couldn't have been listening.) "Personnel in Dept. of Commerce not always as well informed as would be desirable." (Advise them to read AERO DIGEST. And trust in the Lord.) "Last winter we were approaching Kansas City from Wichita behind another plane in preparation for a descent through an overcast. Although continuous range operation was requested by our ground station, this was not adhered to, with the result that by the time the other plane had reworked the beam problem and landed, the ceiling at Kansas City started lowering rapidly, necessitating our return to Wichita." (Use the airplane, and save time.)

Here's a sad case: "Inconvenient and disturbed from interruption of range for broadcast due to Pittsburgh and six airlines in bad weather." (You *were* in a jam! But don't be disturbed. And please don't be inconvenient.) Another unfortunate reports: "Although not directly responsible for a dangerous situation, the interruption of radio range for long weather range broadcast, in such cases as Pittsburgh, has caused me considerable mental anguish." (It takes an iron nerve to stand that sort of thing.)

And so it goes, Mr. President, in report after report, for page after page. These things are not said by Department of Commerce officials, but by the transport pilots themselves, who are forced to risk their lives and the lives of their passengers by flying over inadequately maintained and operated government airways. Whose fault is that? According to the Senate Investigating Committee it is very largely the fault of Eugene Vidal and Rex Martin, whose removal is demanded from positions where they are a menace to safety in the air. It is high time Mr. President, for you to say to these two "Get out!" And when you say it, for the love o' Pete, don't smile.



NORTHWEST AIRLINES, INC.
• The Northern Transcontinental Air Route: Chicago to Seattle via Twin Cities and Sp
Executive Offices: HOLMAN MUNICIPAL AIRPORT, SAINT PAUL, MINNESOTA

July 24, 1936

Hamilton Standard Propellers
East Hartford, Connecticut

Gentlemen:

Northwest Airlines, after a series of tests over the winter months has adopted constant speed propellers for its Lockheed Electra equipment for the following reasons.

Tests conducted last winter, under trying conditions of subzero temperatures dropping as low as 50° below zero, proved that the constant speed propellers could function perfectly under such frigid temperatures. At the same time, it enabled us to obtain full advantage of the power output of the engines under severe snow conditions.

Further proof of their flexibility and efficiency is reflected in the fact that we have been able to reduce by three hours and five minutes the flight time necessary to complete two round trips Seattle to Chicago. Other advantages such as passenger comfort, continual synchronization of engines and elimination of excessive vibration, all have been commented upon by our patrons and pilots.

May we thank you, at this time, for the splendid cooperation extended in making the change-over possible in so short a period.

Very truly yours,
NORTHWEST AIRLINES, INC.

F. W. Whittemore

F. W. Whittemore
Vice President in Charge of Operations

HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT CORPORATION

Aerodynamic Characteristics of The Fowler Wing

●

HARLAN D. FOWLER

Airfoil design has practically reached its maximum, comprehensive and systematic research by the NACA resulting in such several new highly efficient sections that possibility of further improvement is remote and of comparatively small value, although costly to discover.

● Attempts have been made to so design an airfoil that it would develop especially high *L/D* ratio, better minimum drag at cruising speed, etc. Earliest efforts were devoted to increase maximum lift (to provide safer landing speed), and to increase drag so as to decrease length of the run when landing.

Research conducted by NACA for the Bureau of Aeronautics indicated that an airplane equipped with a Fowler variable area wing could reduce landing speed, decrease landing and take-off runs, and that there would also be indications of improved climb with the Fowler partially extended. This device was first tried in 1927 on a Canuck JN; in 1929 on a Pitcairn; in 1934 at the International Competition at Warsaw, Poland, where a similar device was used by Fieseler and Messerschmitt; in 1935 on a Fairchild F-22 by the U. S. Navy and NACA; and more recently on the Martin Bomber.

Combined use of variable area, camber, angle of attack and of the boundary layer, requires only an auxiliary airfoil that is extended or retracted as the occasion demands. The principle is termed a *fowler* to distinguish it from other flap devices. Individual aerodynamic properties of each of these principles is not sufficiently great to justify its use alone, as for example, the percent distribution of the maximum lift coefficient as contributed by the several features given in Table 1.(1)

Based on area alone $C_{L\ max.}$ should vary directly with the fowler chord with it fully extended. However, data available show that with a 20% chord fowler set at —5°, fully extended, the increase is slightly higher or about 25% more than for the normal wing. By virtue of the recess cut-out under the trailing edge of the normal wing, lift is again increased slightly varying with fowler chord.

The major individual increase in maximum lift results from the gap, which appears to increase nearly directly with the chord of the fowler. Variable area is the next most effective factor, with camber a close third. However (by the principle involved), the combination of area and camber actually contributes a greater increase than the gap, and it is apparent that all three factors have a powerful influence in contributing to the maximum lift, and increase with enlargement of the flap chord.

Partial Span and Lateral Control

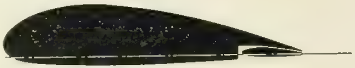
Distribution of maximum lift along the wing span has been investigated and checked with actual performance data in cases where the fowler covered a portion of the wing. The loss of lift is greatest near the fuselage and least at the wing tip. On a tapered wing it is hardly worth while to extend the fowler beyond 80% of the span as the remaining 20% at the tip represents a loss of about 4% from the full span arrangement. However, if the inner end of the auxiliary wing is not extended over the center 20% span, there will be a loss of about 14% from the maximum.

Considering the small possible gain by extending it to the tip, the question of providing for lateral control means becomes involved. The author maintains that due to the powerful lifting capacity of the device, there is no need to sacrifice good lateral control to attain the last ounce of lift. In this respect, conventional ailerons have been used and the lateral control obtained has been satisfactory, even with the fowler fully extended. Experiments(2) have revealed that rolling moments are substantially higher with it extended than when closed, the ideal condition. In these tests, ailerons occupied from 30 to 40% of the semi-span, the smaller span being adequately effective.

TABLE I

	20% Chord Fowler		40% Chord Fowler	
	C_L	% increase	C_L	% increase
Normal wing	1.31	0	1.31	0
With recess	.07	5	.11	8
Fowler at —5° (area)	.32	25	.56	43
At 30° (camber)	.30	23	.42*	32
Gap	.45	34	.77	59
Total	2.45	87	3.17	142

* Set at 40°.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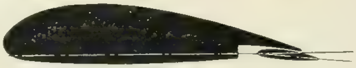
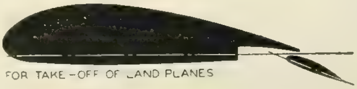
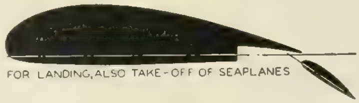

FOR CLIMB AND CEILING


FOR TAKE-OFF OF LAND PLANES


FOR LANDING, ALSO TAKE-OFF OF SEAPLANES

Performance characteristics with various positions of the Fowler wing

Design Loads on Main Wing and Fowler

Comprehensive research on fowlers of 20, 30 and 40% chord shows that if the maximum angle is kept at or below 30° there is a progressive reduction in flap loads with increasing chord, provided advantage is taken of the corresponding decrease in stall speed. Furthermore, if the high speed with the fully extended wing is kept below twice stalling speed, it is possible to add fowlers having a chord up to 30% to a wing whose spars have already been designed for its normal critical loads (except for wings using an airfoil of constant center of pressure movement) that will be sufficiently strong to take the load from the auxiliary wing without appreciably increasing the main wing weight, particularly the rear spar. Because of the necessity of a recess under the trailing edge of the main wing, ribs are consequently shallower and must be strengthened, although not necessarily with considerable increase in weight, although there will be a weight increase by adding the fowlers and controls.

When the fowler is in its fully extended position, longitudinal force assumes a negative value—that is the force tends to close it. At some intermediate point this force becomes zero then tends towards the positive. The control system is therefore designed not to extend the fowlers but to prevent them from closing. With this arrangement and using an automatic hydraulic pressure relief valve system, should the load become too high, the fowlers will tend to move towards the closed position, thus preventing undue strain on the main wing structure. However, the hydraulic device will hold it at

(*Continued on following page*)

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(1) NACA Technical Report 534 Aerodynamic Characteristics of a Wing with Fowler Flaps Including Flap Loads, Downwash, and Calculated Effect on Take-Off.

(2) Results obtained from tests conducted on a full scale plane, and published in a confidential report of the U. S. Navy.

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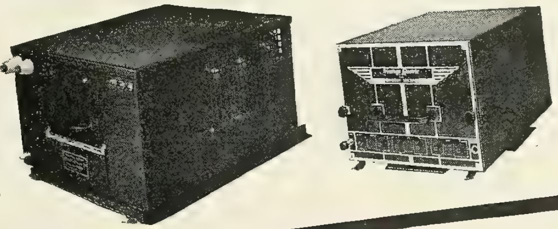

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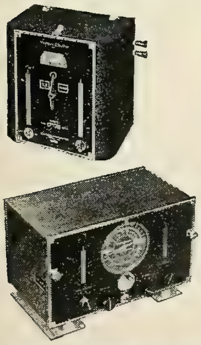

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Fowler flaps in their retracted or closed position

(*Continued from preceding page*)

any desired position.

Throughout the flying angles of attack, the center of pressure on the fowler wing is uniformly forward when in the extended position, at about 30% of its chord. Since the main spar of the flap is located at about 20% chord there is no tendency for flutter since the pressure is constantly aft of the point of support. In the case of a twin-engine installation with the propellers directly in front of it, it was found that the extended fowler minimized turbulence, due perhaps to the gap action on the boundary layer over the wing.

Control Mechanism

There are two methods of operating the fowlers. The original method consisted of fixed tracks, properly curved, attached to the rear spar, with a trolley which is secured to the auxiliary wing, running along the track. Back and forth motion was accomplished either by a continuous cable or by push-pull rods. The second method is the rotating or swinging arm which is pivoted to the rear spar with the fowler suspended at its outer end. The arm swings back towards the trailing edge, thus extending the fowler and automatically increasing its angle, the latter being accomplished by a universal joint. Both systems have been tested and each has merits which the other does not possess. The swinging arm presents a perfectly smooth wing when the fowler is closed. The fixed track has a small portion of its rear end exposed at all times (without causing any appreciable increase in drag) and is less costly to build and lighter in weight than the other method.

Speed of extension or retraction is obtained in several ways. Using manual crank-operated control, movement is from 2.5 to 3 inches to one complete turn of the crank handle. By hydraulic control in one case, movement was accomplished in 15 seconds. There is something to be said about the speed at which fowlers should be operated. They should not be operated too quickly since it gives neither the plane nor the pilot a chance to adjust for the varying conditions. If there is too long an interval, there will be a decided negative influence on landing and take-off, so that a happy medium on speed of operation is important.

Hydraulic and electrical systems are preferable for large planes, the first lending itself to automatic retraction, if the plane's speed becomes excessive. Both systems are dependable and flexible.

Partially Extended Characteristics

Inherent with the extendable feature of the device is the transition or partially extended position. The fowler can be stopped at any intermediate position and several such positions contribute improvement to performance. The accompanying diagram illustrates several positions at which it may be set to give particularly desirable performances, the positions shown being spaced in four locations, the exact positions for the given type of performance varying with airfoil and airplane design.

Longitudinal Stability and Downwash

In the normal wing condition, longitudinal stability is as usually obtained on well-designed planes.

With the fowler device, as it moves outward and to about ⅔ extended position, the change in balance is barely perceptible. In the full out position there is need of more upward elevator movement for landing. Also, due to the increase in length of the combined wing and fowler chord, tail surfaces should be at a slightly greater distance from the center of gravity, or the horizontal tail surfaces made larger than normal, the area of the elevator being at least equal to one-half the total horizontal tail area. This increase is to be expected because at the very high lift coefficients obtainable with the fully extended fowler, the downwash angle is considerably higher. Combined with the low maximum lift coefficient of tail surfaces, this causes the tail to stall at certain speeds. For this condition large elevator movements are preferable to stabilizer adjustment, especially on large planes. Also, there is no tendency to nose over at the take-off or on landing.

Although not completely affirmed, extensive investigations on downwash angles behind a wing using the auxiliary wing indicate that its addition has no appreciable effect on the basic relation between lift, span and downwash at reasonable distances behind the wing. The downwash angle is a direct function of the lift coefficient, but it appears that some correction must be made for the shifting of the angle at zero lift as between the normal wing and the extended fowler. In other words, the angle of attack for all fowler positions and chord sizes is referred to the basic chord line of the normal wing. As it is extended or increased in chord size, the angle at zero lift becomes more and more negative. Since the setting of the tail surfaces is referred to the zero lift chord of the main wing, this variation must be considered.

Landing Distances and Rate of Descent

The maximum lift coefficient obtained by a fowler wing is 3.17, referred to the normal wing area, by using a 40% chord over the entire span. By means of an auxiliary nose airfoil this can be increased to 3.62. At present, for most designs in which the fowlers are used, the maximum lift coefficient is from 2.00 to 2.50, the lower value being attained by using a 20% chord and the latter by using a 30% chord both over 60 to 70% of the wing span. A 40% chord has been used in one wing.

The accompanying chart (from NACA Technical Report 534) shows the variation of the maximum lift coefficient with fowlers of various percent chords in terms of the basic wing chord. As a high lift device is generally used to increase the maximum speed of a plane keeping a given stall speed, it is proper to consider lift in terms of normal wing area, with fowler retracted.

As an illustration of what has been done in full flight tests, some results obtained at Langley Field by NACA are given in Table 2, which shows minimum rate of descent with the fowler fully ex-

(*Continued on following page*)

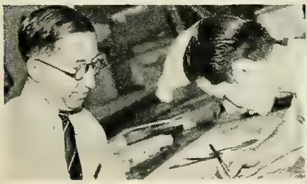
Fairchild F-22 with Fowler flaps in extended position

John B. Fornasero, Chief Flight Instructor, takes a personal interest in each Ryan student.

Paul Wilcox, Flight Instructor, checking the Gossport system of communication.

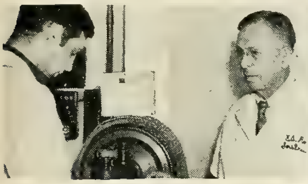
Lt. Comdr. Lloyd Gray, U.S.N. Ret., instructs students in navigation and radio.

Mel Thompson, Ground School Lecturer, the introductory step for new students.



Millard Boyd, Chief Engineer for the Ryan Aeronautical Co., instructor in airplane drafting.

Ernest Moore, Sheet Metal Instructor, explaining problems of bends and allowances.



E. A. Ross, Veteran Aeronautical Instructor, in charge of special State College classes.

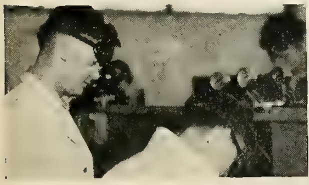
Fred Rohr, Factory Superintendent, under whose direction students learn drop hammer work.

Robert Kerlinger, Chief of Maintenance, instructs in the care and inspection of aircraft engines.

Walter Balch, Chief Ground School Instructor, an authority on engines and planes.

Virgil McKinley, Assistant Shop Instructor, explaining wooden construction.

Fred Magula, Sheet Metal Superintendent, in charge of this branch of Ryan training.



Ford Lehman, Welding Instructor, guides the students' first efforts with the torch.

Claude Ryan, left, and Earl Prudden, right, President and Vice-President, are always available for the discussion of personal problems with their students.

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(*Continued from preceding page*)

tended was about 8.7 ft./sec. as compared to 9 ft./sec. with the wing closed. Data were obtained on the *F-22*, results being average of two landings. *F-22* has a Fairchild fuselage mounting a specially designed variable area wing. The plane was powered by a 95 hp engine. Gross weight was about 1600 lbs., wing span 31 ft., normal chord 4 ft. 4 in., normal area 132 ft.^{2}, fowler area 27.3 ft.^{2}, total area 159.3 ft.^{2} A 30% chord fowler over 71% of the span was used with conventional ailerons whose area was about 7.2% of the normal wing area. Wing load based on normal area was 12.1 lbs./ft.^{2}, and power loading 16.8 lbs./hp.

Running along the ground for take-off or landing, the proximity of the earth causes a reduction in the angle of attack due to induced lift. Also, the higher the lift, the greater the induced angle of attack of the wing (as this varies directly with the lift), thus allowing a shorter landing gear. The ground angle being smaller, it is possible to use a true streamline fuselage, with a resultant saving in parasite drag.

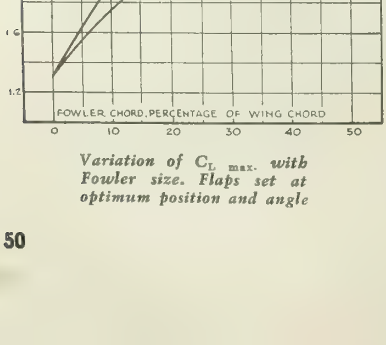
Take-off of Landplanes

Take-off distances for *F-22* are in Table 3 which shows a reduction in total distance of 22%.

Theoretical study(8) of the effect of high lift on take-off, with varying power and loading per square foot, showed the fowler wing should be able to reduce total take-off distance by from 30 to 45%, including the clearance of a 50-ft. obstacle.

It should be explained that the fowler is able to contribute to high reduction in take-off run due to the combination of high lift with low drag. The first contributes to low take-off speed, thus favoring propeller thrust. With low drag, the excess thrust is considerably improved.

While the fowler has lower drag and thus less braking effect on landing, the high lift reduces the landing speed accomplishing results similar to the split flap. However, it should be pointed out that due to the high *L/D* ratio with the fowler wing it is necessary for the pilot to use only ordinary flight technique. This is particularly desirable in forced landings.

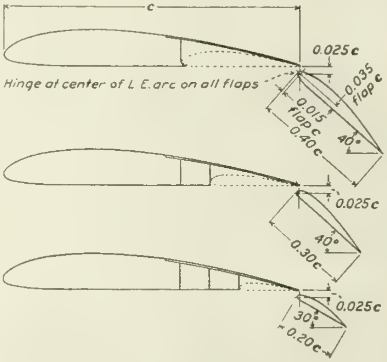


Variation of $C_{L\ max.}$ with Fowler size. Flaps set at optimum position and angle

Climb and Ceiling

Wind tunnel research on a complete model(4) indicates that with the fowler extended about 25%, *L/D* ratio is higher and occurs at a larger lift coefficient. When applied to a given design, service ceiling can be improved. With planes supercharged to high altitudes, the lift coefficient is larger, and with smaller drag the ceiling is bettered. This characteristic will not be detectable near sea level, as compared with the normal wing, but it should appear at altitudes.

Flight tests on *F-22* at 2000 ft. indicated that, with the fowler extended ⅓, rate of climb was as good as with it closed, but the angle of climb was higher.



Wing with various Fowler flaps (From NACA report No. 534)

On another plane it was found that at 9000 ft., rate of climb was appreciably higher than for the normal wing, and at low speed the gain was about 10%.

Also, test results seem to indicate the possibility that when one of two engines fails that, by partially extending the fowler, both rate of climb and ceiling can be improved.

Seaplane Take-off

A valuable field of application of the fowler wing is for flying boats, especially those having long range and large payloads. While the controllable-pitch propeller has materially reduced take-off problems for such ships, its combined use with the flap offers further improvements. The problem of a large flying boat is to carry a large fuel load plus passengers, mail and equipment, but this usually results in increasing take-off speed. With the higher take-off speed, water resistance of the hull may become large enough to actually prevent a take-off. With the high lift of the fowler wing, take-off speed is reduced and propeller thrust increased, providing greater excess thrust for acceleration. Even at the full out position, *L/D* of the wing is high enough to cause a substantial reduction in the total water resistance plus air drag.

TABLE 2

	Fowler Closed	Fowler Extended
Maximum C_L	1.35	2.37
Minimum speed (mph)*	58.8	44.4
Gliding speed at landing (mph)	60.7	49.
Distance of glide (ft.)**	540.	308.
Distance along ground (ft.)***	347.	238.
Total landing distance (ft.)	887.	546.
Reduction of total run (%)	—	38.

* Without power. ** After clearing 50-ft. obstacle. *** With wheel brakes.

The most effective method of using the fowler is to start extending it about 10% below take-off speed, so that it becomes fully extended only at the instant of take-off. Thus the plane starts its run with the normal wing, gets over the hump and speeds on until at some predetermined speed the fowler begins to extend.

Table 4 calculates values for a seaplane of 15,000 lbs. (gross), 1000 ft.^{2} normal area and 1000 hp using a 20% chord fowler occupying 62% of the span. In this case the time interval between commencing to extend the fowler to the fully extended position, was about 6 seconds, illustrating the importance of not permitting too long a time for the device to completely open, although a little longer time could be permitted without materially affecting take-off characteristics.

TABLE 3

	Normal Take-Off	Fowler Extended 44%	Fowler Extended 87%	Fowler Extended 100%
Run on ground (ft.)	490	440	315	380
Distance to clear 50-ft. obstacle (ft.)	485	410	385	340
Total (ft.)	975	850	700	720
Time (secs.)	11–12	—	8	—

It should also be possible to set the wing in relation to the hull at a lower angle, thus reducing hull drag at cruising speed. Another advantage is that the trim angle of the hull can be maintained nearly constant at get-away because the fowler will pull it off.

The fowler wing can also be utilized to increase fuel load with the same wing area, or alternatively, the same fuel capacity can be kept and the wing area reduced.

TABLE 4

	Time (sec.)	Distance (ft.)	Take-Off (mph)
Normal wing	38.0	2410	70.5
Fowler fully extended*	35.2	1766	55.5
Normal and Fowler extended**	27.6	1400	55.5

* Fully extended when run is commenced. ** Commence to extend at 70 ft./sec. and all out at get-away.

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(8) NACA Technical Report 534 *Aerodynamic Characteristics of a Wing with Fowler Flaps Including Flap Loads, Downwash, and Calculated Effect on Take-Off.*

(4) Tests conducted by the Glenn L. Martin Co. on a complete airplane model.

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Spartan Four-Place "Executive" Monoplane

● Spartan Aircraft Co. has resumed active participation in the aircraft industry with the production of the four-place all-metal *Executive* model, a low-wing cantilever cabin plane which bears resemblance to the modern airline transport.

Additional views of this plane are featured on the front cover of this issue of Aero Digest.

Fuselage construction follows the semi-monocoque design, with the loads carried through a steel boom, triangular in section, from the wing spar back to the rearmost shell ring which is 62.5" forward of the rudder hinge line. Fuselage tubing is 4130 chrome molybdenum steel, heat treated before fabrication to an ultimate tensile strength of 125,000 lbs./in.^{2}

Wing is of the monospar type with metal ribs and covering, and tapering in plan form and thickness. Chord at the longitudinal centerline is 9 ft., while at the tip it measures 4.5 ft. An NACA 2418 section is used at the root and an NACA 2406 section at the tip. Construction provides a spar built of three steel tube trusses arranged in triangular form.

Centerline of the triangular spar is located on the 30% element and is swept back approximately 2.5°. Spar stations are 20" apart, measured along the chord line and ribs are located at these points. The spar is so built that the ratio of the width to the depth of the triangular section is constant along the span. Spar construction provides for a three-sectioned unit—the stub spar which is an integral weld assembly with the fuselage structure and the spar in each outer wing panel which is fastened to the stub spar by taper pins. The stub spar extends to that point in the wing where the landing gear is attached, and its members are designed to take the full load from the gear in the ground loop condition. Ribs are made in two parts, the leading and trailing edges attaching separately to the spar.

Flaps are all-metal and are actuated by a vacuum pump operated by a lever in the cockpit near the control which operates the landing gear.

Tail construction is of the all-metal cantilever type, the tail wheel, stabilizer and elevator loads being taken by a monocoque shell aft of the rearmost fuselage ring.

Landing gear is retractable, hydraulically, wheels folding inwardly into wells on the underside of the wing. Each leg of the gear is equipped with a 24" Streamline tire and hydraulic brakes. Tread is 10 ft. 4 in. The tail wheel is fully swivelling through 360°, and is provided with an oil shock absorber unit and 10.5 in. Streamline wheel and tire.

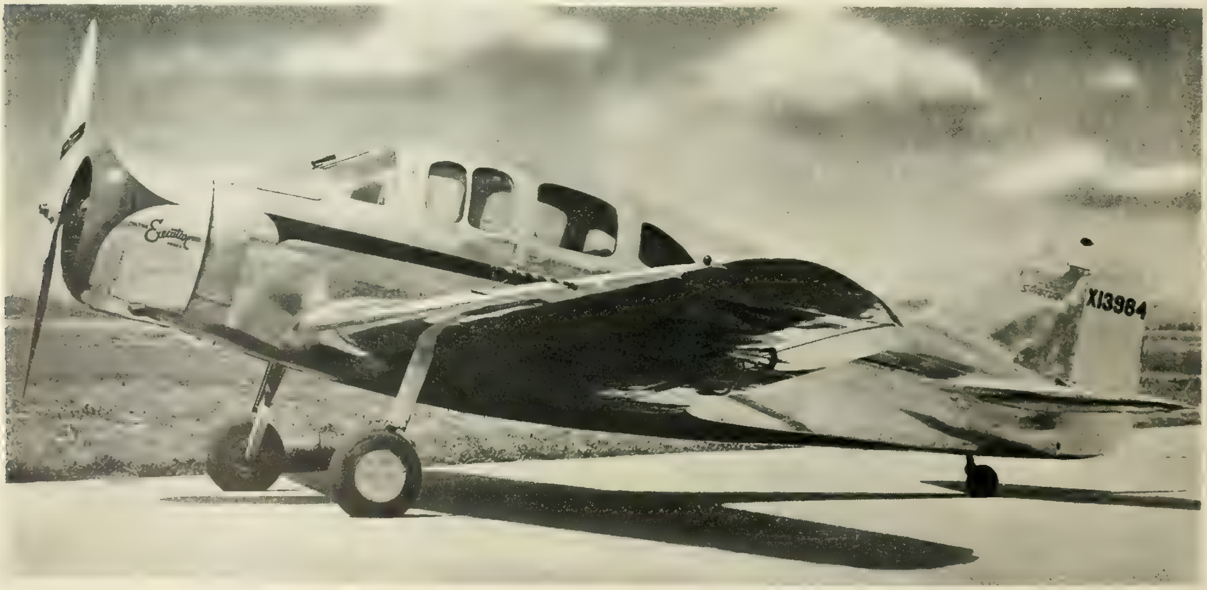
Power is supplied either by the 285 hp Jacobs L-5 or 450 hp Pratt & Whitney Wasp Jr. SB engine.

Specifications and performances of the Spartan Executive are as follows:

Wing span	39 feet
Length overall	27 feet 3.5 inches
Wing area	250.8 square feet
Dihedral	5.5 degrees

Performances

	Jacobs L-5	P & W Wasp Jr.
Cruising speed, sea level (mph)	160	190
Cruising speed, 5000 ft. (mph)	168	205
Landing speed (mph)	50	54
Service ceiling (ft.)	17,500	22,000
Absolute ceiling (ft.)	19,500	24,000
Cruising range (miles)	600	950
Rate of climb (ft./min.)	1200	1460



The all-metal Spartan Executive with full cantilever retractable landing gear

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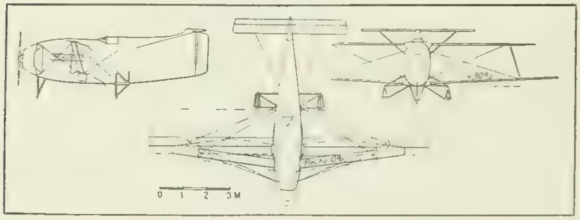
☐ **Airplane & Engine Mechanic**
☐ **Sheet Metal Work**
☐ **Welding**
☐ **Radio**
☐ **Pilot's Ground**

Digest of Technical Articles from Foreign Publications

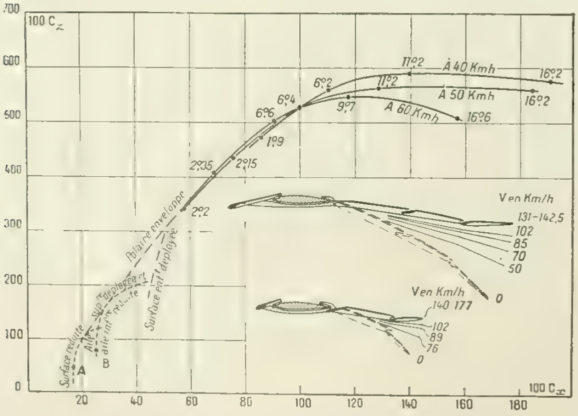
Aerodynamics

The Experiments on "Varivol"; (Les Essais du "Varivol'; J. Gerin, a la Grand Soufflerie de Chalais-Meudon; L'Aeronautique, No. 205, Juin, 1936).

"Varivol" is a variable area airplane where the wing area extension is obtained by expanding the chord of the two wings of its biplane cell. Extension is flexible using rubberized fabric and extensible ribs. Tests included runs to determine general behavior at gradually increasing speeds from 70 to 110 mph; tests to verify the operating mechanism for wing area extension which were made simulating actual flight conditions; verification of the effect in change of curvature at different speeds; and determination of the airplane characteristics. The author concludes that tests substantiated the feasibility of incorporating in a design a variable wing area device which at high speeds uses thin, efficient profile of maximum cleanness, and yet at low speeds results in a wing of four times the wing area with considerable lifting characteristics. He feels that the flexibility of the extended structure is hardly a handicap. It appears that flight tests were also initiated with "Varivol" and the article states that flights have confirmed so far the wind tunnel experiments which indicated good stability, balance and flying characteristics.



Three-view outlines of the "Varivol"



"Varivol" polar referred to unextended wing area

Airworthiness Requirements

Comparison of German Aircraft Structural Requirements with Those of C.I.N.A. (Vergleich der Deutschen Festigkeitsvorschriften fur Flugzeuge mit denin der C.I.N.A.; von Hans W. Karl, und Karl Otto, Luftwissen, Bd3, Nr6, Juni, 1936).

This is the second and concluding part of the paper. It covers the comparison as regards the structural design requirements of tail surfaces, landing gear and float design, surface controls, and body and engine mounts. As in the first part it sets forth the basic requirements of the German and C.I.N.A. specifications and analyzes their differences. In the concluding chapter the authors stress the fact that German airworthiness requirements take greater care to base the specified applied loads on aerodynamic characteristics of the design rather than make them merely generally dependent upon certain broad factors such as weight and power loading only. From the structural viewpoint there is a greater discrimination made in German requirements of the nature of loads which design a given member or assembly, and factor of safety required is governed by these facts. The yield limit factor of safety differs by 8%, being 1.35 in German specifications and 1.25 in those of C.I.N.A. In general the writers feel that besides fully complying with C.I.N.A. specifications, German requirements are in many respects more rigorous and superior.

Structures

A Routine Method of Stressing for Three-Ply Covered Fuselages, With Special Reference to Some Mechanical Tests on a Particular Fuselage; H. Davis, B.Sc., D.I.C.; Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1694, October, 1935.

An approximate theory, convenient for routine use in stress analyzing wood monocoque fuselages, is outlined. The method described employs the engineer's usual theory of bending and torsion with tension field corrections based on Wagner's theory. The results—mainly as regards deflections—given by the method when applied to the particular fuselage tested are compared with those obtained experimentally. It appears that for the fuselage tested the method outlined gives, on the whole, good agreement with experiment, but it is noted that the comparisons made are not critical tests of the theory.

Engines

German Transportation Diesel Engines (Der Deutsche Fahrzeug-Dieselmotorenbau, Mercedes-Benz; Ludwig Wagner; Deutsche Motor-Zeitschrift, 20 Juni, 1936).

A technical history is given of the Daimler-Benz company's work in development of Diesel engines for surface transportation. After a general outline of the basic type adopted, description is given of various engines built from 1928 until the present. In addition to constructural detail, data includes consumption figures, unit weights, etc. Essential data is presented in a table and four charts giving bmep, power over consumption curve, and type OM 77 and OM 79 engine characteristics curves. The latter include bmep, torque, bhp, and specific fuel consumption. The paper is of general interest in connection with the recent trend of development of Diesel engines and their extensive use in Germany in air transportation.

Structures

The Stability of a Monocoque in Compression; J. L. Taylor, D.Sc., A.M.I.N.A., of the Design Staff, Armstrong Whitworth Aircraft, Ltd., Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1679, June, 1935.

Theoretical formulas are derived for the stable compression load on a flat or curved monocoque (stiffened-skin) panel, analogous to the well-known expressions for the stable load of a flat sheet and thin tube, respectively. A numerical example shows that the load for a flat panel is much smaller than for one with moderate curvature, the first requiring relatively heavy frames to develop the same stress before waving as the latter. It is shown also that some form of transverse stiffening of the skin is, however, necessary if advantage is to be taken of the curvature.

Vibrations

Flutter Experiments on a Model Wing Fitted With a Dead-Center Aileron Control; V. M. Falkner, B.Sc., A.M.I.Mech.E., W. P. Jones, B.A., and C. Scruton, B.Sc., of the Aerodynamics Dept., N.P.L.; Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1686, October, 1935.

Tests presented in this report were undertaken to find the effect, as a preventive of wing flutter, of an aileron control having a dead-center at the neutral position. Critical wind speeds for flutter were observed over a range of aileron angles for conditions: (a) with a dead-center aileron control; (b) using three different "pilot control" springs; and (c) with a reversible control of the normal type, mainly with one "pilot control" spring.

The paper is supplemented by calculations of the critical flutter speeds, with control column locked, of a typical cantilever wing, fitted with a range of dead-center aileron controls defined by a simple law.

Experiments and calculations show that it is possible for a wing fitted with a dead-center aileron control at the neutral position to flutter when the aileron is displaced by a comparatively small angle from the neutral position. No flutter oscillating over the dead-center could be induced on the model. However, it is not established conclusively that a motion of this kind is impossible, since theory and model experiments are both subject to certain unavoidable limitations in the investigation of this question.

(Continued on following page)

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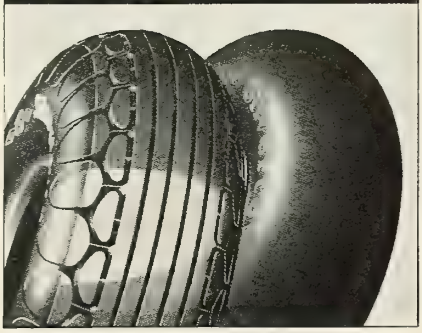

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(Continued from preceding page)

Airports

*Rhein-Main World Airfield (Weltflughafen Rhein-Main, Flugsport, Nr*14, 8 *Juli,* 1936).

Giving a brief historic review of the importance of Frankfurt-am-Main in aviation and particularly in its national aspect, the article offers some interesting statistics of present traffic at this terminal. In the last two years, increase in air travel, measured by arrivals and departures as well as passengers and cargo carried, is given as 113.5%. A brief description is given of the new airfield opened on July 8, 1936, and its future importance is forecast. The article is accompanied by a photograph of a model of the field and its map.

Structures

Some Features of the Behaviour in bending of Thin-Walled Tubes and Channels; D. Williams, B. Sc., A. M. I. Mech. E. Air Ministry (Great Britain); Aeronautical Research Committee Reports and Memoranda No. 1669, 28*th February,* 1935.

Since in certain respects the commonly accepted theory of bending is not applicable for the case of thin-walled structures, it was considered desirable to examine the bending characteristics of such structures with particular reference to shear stresses and the position of the flexural axis. This report deals primarily with the two closely related problems of finding (a) the bending shear stresses induced when a beam of thin-walled section is laterally loaded at its flexural axis, and (b) the flexural axis for thin-walled sections. It is shown that the shear stresses in the flanges of either closed tubular sections or open channel sections, where the flange of the section is wide and its thickness is comparable with, or less than, the thickness of the web, may be important. It is also demonstrated that for the average open section the flexural axis is completely outside the section.

A Successive Approximation Method of Solving the Continuous Beam Problem; D. Williams, B. Sc., A.M.I. Mech. E. Air Ministry (Great Britain); Aeronautical Research Committee Reports and Memoranda No, 1670, 31*st May,* 1935.

The method described in this report is based on the general method, due to Professor Hardy Cross, of considering a structure one joint at a time, the other joints meanwhile being considered fixed. The general problem is considered in relation to continuous beams under the following conditions: (a) cross section and lateral loading constant over each bay and no end loads; (b) as for *a* but with end loads; (c) constant cross section and end load, but arbitrary lateral loads, over each bay; (d) cross section and lateral loads arbitrary but end load constant for each bay. Detailed numerical examples are given for cases *a*, *b* and *d*.

Plan view of Rhein-Main Airfield

The Calculation of the Loads and Bending Moments in the Members of a Plane Braced Frame With Rigid Joints; J. Morris, B.A., A.F.R. Ae.S.; Air Ministry, (Great Britain); Aeronautical Research Committee Reports and Memoranda No. 1672, 23*rd March,* 1935.

This paper extends the process given by Professor Hardy Cross to the general case of a plane braced frame with rigid joints. By taking account of the deflections of the members of a braced frame, a general successive approximation process is developed for determining the end loads and bending moments in the members of any plane frame with rigid joints. In addition, a method is given for obtaining the angular as well as linear deflections of the joints from the results of this process. Several fully worked examples illustrate the application of the process.

Flexural and Shear Deflections of Metal Spars; I. J. Gerard, M.Sc., A.M.I.C.E. and H. Boden, B. Sc. (Eng.); Air Ministry (Great Britain); Aeronautical Research Committee Reports and Memoranda No. 1671, 7*th June,* 1935.

Five typical spars were tested within the elastic limit as simply supported beams carrying one or more concentrated lateral loads. These were also tested with combined end loading and lateral loading, with various ratios of bending stress to end load direct stress; at a selected ratio each spar was tested to destruction. The apparent values of the effective flexural stiffness *EI* and the elastic shear constant *r* were determined.

It is concluded from these tests that spars may, in general, be divided into three categories: (1) hardened and tempered steels; (2) relatively softer steels; and (3) duralumin. There is no appreciable variation in *EI* in category (1), but there is an appreciable reduction in the value of *EI* towards failure in categories (2) and (3).

Aerodynamics

Certain Aerodynamical Problems Connected With the Use of Flaps; N. E. Joukowski's Central Aero-Hydrodynamical Institute; A. K. Martinoff; The Technic of the Air Fleet, USSR, N6, June, 1936.

Use of flaps introduces certain new problems confronting both the designer and pilot. The author reviews these problems basing his paper principally on the result of experiments conducted at the N. E. Joukowski's Central Aero-Hydrodynamical Institute. The greatest part of the data is based on tests with split flaps and combination of split flaps with Handley Page front slot. Considerable data are given on partial effect of flaps, thickness and camber effect on maximum lift increase, and flow exploration behind flapped airfoil. Observed downwash angles are compared with those obtained from calculations using Munk's and Russian formulas. These moments are given for balanced and unbalanced flaps and other pertinent questions are reviewed. The article contains numerous polars and other test data and, although brief, presents interesting additional information on this subject.

The Influence of a Uniform Jet on the Lift of an Aerofoil; H. Glauert, F.R.S. (Revised by H. B. Squire, M.A., Dec., 1935); Air Ministry (Great Britain); Aeronautical Research Committee Reports & Memoranda No. 1602, *January,* 1934.

This report gives theoretical formulas for the lift of an airfoil in the presence of a jet of uniform velocity, or in the presence of an infinite series of such jets. The analysis is confined to motion in two dimensions and is limited by the condition that the induced velocity caused by the airfoil at the nearest surface of discontinuity must be small compared with the velocity of the undisturbed flow.

Calculations indicate that the lift of an airfoil is increased by a jet of increased velocity passing above it. When the airfoil is in the jet, the lift is a maximum in a position slightly below the center of the jet and also decreased rapidly when the breadth of the jet is less than the chord of the airfoil. Theoretical results are in general agreement with experimental results giving the effect of a slipstream on the lift of an airfoil.

Engine Cooling

Note on the Cooling of Aircraft Engines With Special Reference to Ethylene Glycol Radiators Enclosed in Ducts; F. W. Meredith, B.A.; Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1683, *August,* 1935.

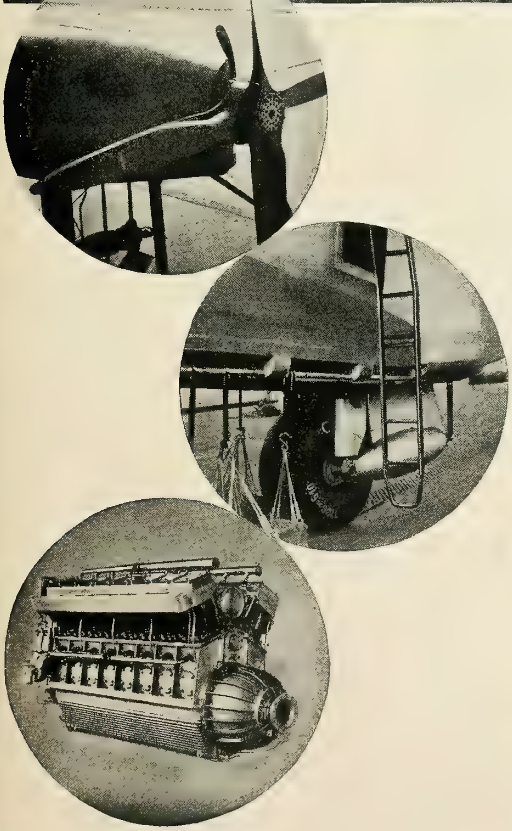
Recent increase in the speed of airplanes has brought the question of cooling drag into prominence and forced the application of the principle of low velocity cooling. An analysis of the performance of a cooling system enclosed in a duct was therefore undertaken to guide further research and design.

The report develops the theory of the ducted radiator and provides a basis of calculating the drag. The effects of compressibility are also investigated.

The analysis demonstrates that the power expended on cooling does not increase with speed for a properly designed ducted system but that, owing to recovery of waste heat, a thrust may be derived at speeds of the order of 300 m.p.h. Attention is also drawn to the importance of the momentum of exhaust gases at high flight speeds.

The Hindenburg . . .

ANOTHER AWARD FOR SKF PERFORMANCE



WHEN the Hindenburg glides through Cloudland, her Diesel engines turn on SKF Bearings . . . her control mechanism operates on SKF Bearings . . . her propellers, landing wheels, generators, all move upon SKF Bearings.

SKF Bearings are invariably preferred along the skyways where human lives and the development of a new industry depend upon *performance*. Their dependability is also widely utilized on fast streamlined trains, speedy ocean liners and other mechanized marvels that front-page the newspapers of the world.

It is with a sense of pride that SKF considers the specifications for its bearings on the Hindenburg not merely as another order for bearings, but as another award for performance.

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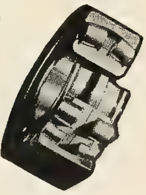

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THOSE who want the best performance available in the less-than-$3,000 class owe it to themselves to investigate the DeLuxe Model "90" Warner-powered Porterfield airplane which sells for $2795 fully equipped with brakes, tail wheel, Townend speed ring, navigation lights, airspeed indicator and compass.

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who furnish position lights for Porterfield airplanes congratulate PORTERFIELD on the manufacture of his 1000th AIRPLANE and on the development of his low-priced ZEPHYR, just announced.

Recent Aeronautical Patents

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office.

Means for preventing formation of ice on aircraft. Lawrence K. Mahaffey, Columbus, O. (2,046,521)

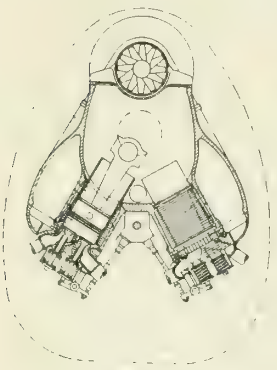
Spinner. Erle Martin, Hartford, Conn., assignor by mesne assignments to United Aircraft Corp. (2,046,522)

Screw propeller. Manfredi Palumbo, Vargas, Genoa, Italy. (2,046,538)

Control mechanism for airplanes. Boleslaw Malinowski, Buffalo, N. Y. (2,046,570)

Controllable propeller. Paul F. Hackethal, Williamsport, Pa., assignor by mesne assignments to Aviation Manufacturing Corp. (2,046,625)

Air-cooled engine. Fritz Gosslau, Berlin-Charlottenburg, Germany, assignor to Siemens & Halske, Aktiengesellschaft, Siemensstadt. (2,047,026)



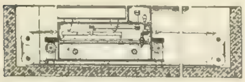
Manufacture of substitute for natural rubber. Francis J. J. van Cant, Batu Pahat, Johore, Straits Settlements. (2,046,662)

Aeronautical propeller. Erich Geil, Oberusel, and Heinrich Ebert, Frankfort - on - the - Main, Germany, assignors to American Lurgi Corp. (2,046,817)

Gyroscopic position finder. Fletcher M. Young, Berkeley, Calif., assignor of one-half to Michael C. Casserly, San Mateo, Calif. (2,046,890)

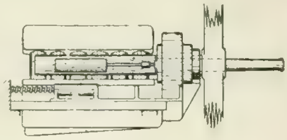
Spark plug. George M. Paulson, New York, N. Y., assignor to The B. G. Corp. (2,047,031)

Aircraft weighing means. C. A. Smith, Orange, N. J. (2,047,038)



Device for photographic survey from aircraft. Erich Horner, Berlin, Germany. (2,047,070)

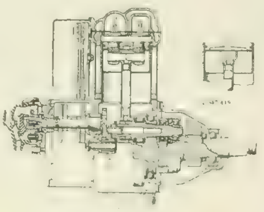
Mounting of aircraft guns. Erich Knoller, Vienna, Austria. (2,047,074)



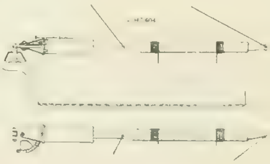
Temperature compensated gyroscope. Mortimer F. Bates, Brooklyn, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,047,186)

Cotter pin. Frank Sipos, Detroit, Mich. (2,047,295)

Internal combustion engine. Roger K. Lee, Highland Park, Mich., assignor to Chrysler Corp. (2,047,419 and 2,047,420)



Landing sail for aircraft. Rudolf Weichardt, Bremen, Germany, assignor to Krafft & Weichardt. (2,047,604)



Fastener (spring). George A. Tinnerman, Rocky River, Ohio, assignor to Albert H. Tinnerman. (2,047,298)

Helicopter and rotating wing aircraft. Raoul Hafner, Vienna, Austria. (2,047,776)

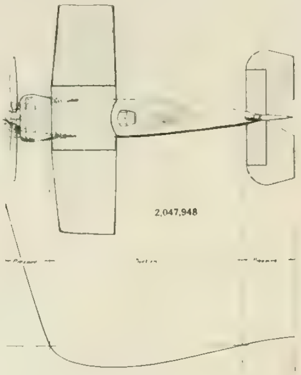
Internal combustion engine. Alois Kreuzer, Augsburg, Germany, assignor to Maschinenfabrik Augsberg, Nürnberg, A.G. (2,047,785)

Piston for internal combustion motors. Elmer C. Long, Detroit, Mich. (2,047,788)

Rate of flow gauge. Emerson Clymer, Quakertown, Pa. (2,047,854)

Internal combustion engine. Newell O. Allyn, South Gate, Calif. (2,047,933)

Cowling for aircraft motors. Robert G. Breene, Carl F. Greene and James B. Brelsford, Dayton, Ohio. (2,047,948)



Photographic apparatus. Sherman M. Fairchild, New York, N. Y. (2,048,439)

Pedal construction. Alfred H. Hofer, Dayton, Ohio, assignor to Bendix Aviation Corp. (2,048,448)

Release device for inflatable flotation devices. Henry Ernest Heigis, West Orange, N. J., assignor to Walter Kidde & Co., Inc. (2,036,695—renewal 20,047)

Rotary internal combustion engine. Henry D. Smelsor, St. Charles, Mo. (2,048,825)

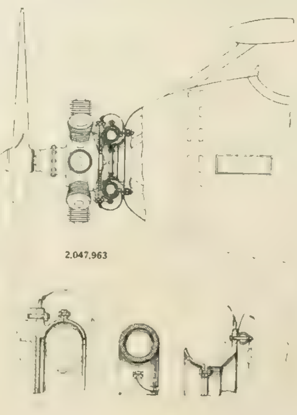
Joint. Hugh C. Lord, Erie, Pa. (2,047,976)

Aircraft aerial and control. Wylie G. Logue, Mineola, N. Y., assignor to Radio Corporation of America. (2,048,015)

Hydraulic shock absorber. William J. Smith, Philadelphia, Pa., assignor to Jos. B. McCall, Jr. (2,048,037)

Engine starting apparatus. Roland Chilton, Keyport, N. J., assignor to Eclipse Machine Co. (2,048,057)

Aircraft engine mount. Edward L. Hoffman, U. S. Army, Dayton, Ohio. (2,047,963)

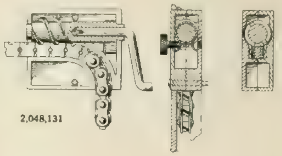


Engine. Philip Lane Scott, San Mateo, Calif. (2,048,223)

Internal combustion engine. Arnold Zoller, Berlin, Germany. (2,048,243)

Air circulation valve in the supporting surfaces of airplanes. Franco Mazzini, Milan, Italy. (2,048,278)

Adjusting hardware for sashes and the like. Sern Madsen, Clinton, Ia., assignor to Eugene J. Curtis and Charles A. Armstrong. (2,048,131)

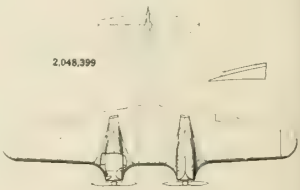


Multiple parachute arrangement. Edward L. Hoffman, Dayton, Ohio. (2,048,159)

Device for damping the oscillation of the revolving wings or blades of aircraft. John W. Dyer and David Kay, Edinburgh, Scotland, assignor to Kay Gyroplanes, Ltd. (2,048,326)

Internal combustion engine. Thomas Noah Smith, San Antonio, Tex. (2,048,826)

Airplane. Grover Loening, Mill Neck, N. Y., assignor to Grover Loening Aircraft Co. (2,048,399)



Supplying fuel to internal combustion engines. Stig Olsen, Stockholm, Sweden, assignor to Hesselman Motor Corp., Ltd., England. (2,048,406)

Gyroscopic position finder. Fletcher M. Young, Berkeley, Calif., assignor of one - half to Michael C. Casserly. (2,048,834)

Liquid spray device. John P. Desmet, Modesto, Calif., assignor of one-half to E. R. Hawke. (2,048,847)

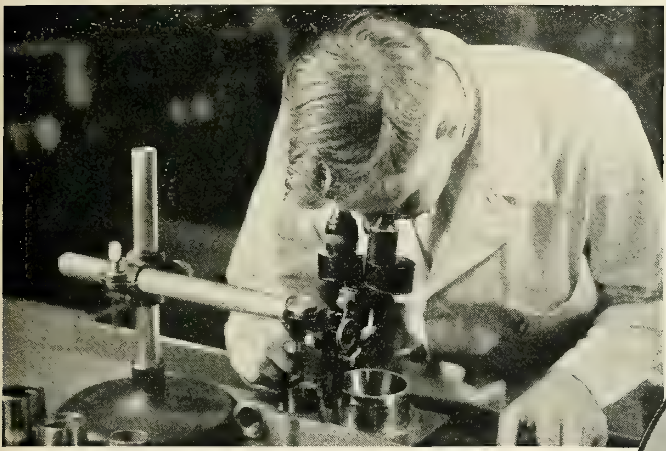
Spark plug. Hector Rabezzana, Flint, Mich., assignor to General Motors Corp. (2,048,891)

Magneto. Walter J. Spengler, Sidney, N. Y., assignor to Bendix Aviation Corp. (2,048,896)

Parachute. Sueto Nonaka, Naoiri-Gun, Japan. (2,048,963)

METAL or MEN

Both Must Pass the SEARCHING EYE of AVIATION



TWA Maintenance Inspector examining airplane parts through powerful microscope. Just one of several steps of rigid inspection required.
Photo courtesy TWA NEWS SERVICE.

THERE'S NO MIDDLE GROUND IN AVIATION
Either You're RIGHT or You're WRONG

Just as these airplane parts must pass the revealing tests of microscope and Magnaflux inspection—so must the men who enter aviation present a flawless background of accepted training. There is no middle ground. Either you're RIGHT or you're WRONG. Many are rejected. Only those with the right kind of training are selected.

The Opportunities are Many And the Pay is High For Men With the RIGHT KIND of Training

Lincoln men get jobs. . . . In Europe,—in Asia,—in India,—in Central and South America as well as with leading Airlines and Factories of the United States. . . . Lincoln trained men hold key positions in Aviation with good pay. They got there because they had what Aviation requires—the right kind of training.

It is no accident that Lincoln men get to the top quicker. We've been training men for aviation for 16 years. We *should* know how. We do. Add to our experience, the finest of modern equipment and training facilities—and you have the answer. Aviation recognizes Lincoln's superior training methods and—thanks to its executives—is generous in its selection of Lincoln Graduates.

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If you're interested in Aviation—interested in a good job with good pay—investigate Lincoln. Send for our new Catalog. Full details of all courses sent free. Mail Coupon Now.

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Reasons Why Men Prefer Lincoln

- Government Approved for all flight courses up to Transport course.
- One year Gov. Approved Mechanics Course qualifies you for Mechanics License.
- Our graduates find ready employment with leading Airlines and Factories.
- A thoroughly equipped flight and mechanics school—12 high class training planes, 4 types—shop and laboratory equipment includes Whirlwinds, Wasps, Cyclones, Packard Aircraft Diesel.
- Operates Government Approved Repair Station where variety of planes are overhauled and repaired.
- Board and Room to students in exchange for part time employment.

E. J. Sias, President,
Lincoln Airplane and Flying School,
306-F Aircraft Bldg.,
Lincoln, Nebraska

Please send your catalog and full information about your courses of training.

Name ....

Address ....

Age ....

City .... State ....

EQUIPMENT and METHODS

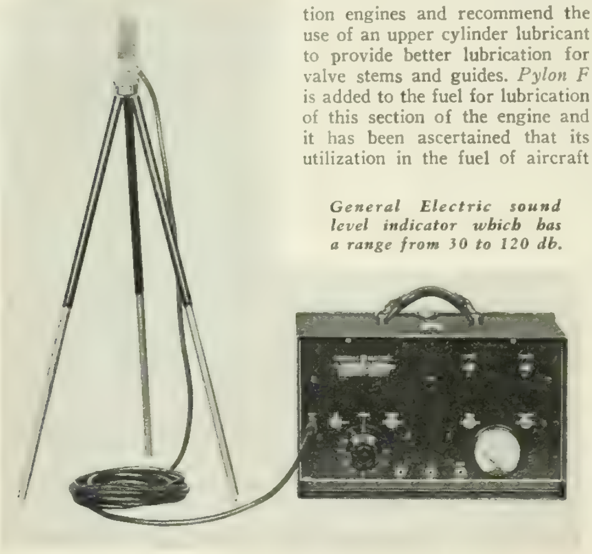
Sound-Level Meter

Quantitative measure of noise independent of the personal element, and results commensurate with sensations experienced by the car are possible with the sound-level meter announced by General Electric Co. The meter has a range from 30 to 120 db., and was developed to provide performance in accord with the new ASA standards.

The microphone is a non-directive, piezo electric type with practically flat frequency response up to 800 cycles/sec., and is shielded against stray electric fields, particularly for use in the neighborhood of electrical machinery.

The five-stage amplifier is resistance - transformer coupled and has small-size low-drain tubes mounted in shock-reducing sockets. A switch permits selection of either a flat-frequency response to measure sound intensity, or a weighted response which approximates that of the ear at a loudness of 40 db. The sound-level meter is calibrated to read in decibels above the standard reference level of 10^{-16} watts/cm^2 at 1000 cycles. Jacks are provided in a 500-ohm interstage circuit to permit use of auxiliary equipment such as an analyzer or a vibration velocity unit or special filtering and control circuits. A receptacle allows for connecting external batteries where the instrument is to be used on permanent location, and a mouth-blown calibrating unit insures accurate overall field calibration. Factory calibration is obtained by placing the microphone in a standardized sound field.

Complete, the instrument weighs approximately 39 lbs., and all parts, including microphone, tripod, calibrating unit, and batteries are contained in a metal case measuring 15.75″ × 9.50″ × 8.25″.



General Electric sound level indicator which has a range from 30 to 120 db.

Friction-Free Lubricant

Eastern Aeronautical Supply Co., Roosevelt Field, N. Y., is distributing *Pylon,* a colloidal graphite friction proof lubricant available in two types for aircraft engine use.

Various engine manufacturers recognize the value of upper cylinder lubrication in internal combustion engines and recommend the use of an upper cylinder lubricant to provide better lubrication for valve stems and guides. *Pylon F* is added to the fuel for lubrication of this section of the engine and it has been ascertained that its utilization in the fuel of aircraft engines so lowers coefficient of friction that rpm is markedly increased. This results not only in fuel economy but also in greater longevity for engine parts.

Pylon C is added to the oil to be used during running-in tests either of new or major-overhauled engines. Being a colloidal graphite product, it forms a so-called colloidal solution with the oil. Since the separate particles of the graphite are sub-microscopic, the proportion of surface to content is high.

The circulating oil carries the particles to fissures and cavities in the bearing surfaces, fills them in and coats them with a submicroscopically thin coherent film. This process is based on the greater affinity between graphite and metal, than between oil and metal. It is an adsorption process; the graphite particles which adhere to the metal form a body with a molecular structure metal/graphite or rather graphite/metal. Under these circumstances, the graphite particles can only be torn away from the metal surfaces by unusually severe working conditions, and, when once the high spots are broken off, by metallic friction which is only slightly greater than liquid friction. Under these circumstances there is no overheating and the possibilities of scoring parts are avoided.

Machine For Testing Grease Stability

Designed and developed by the Bearing Engineers Committee, a machine for testing the stability of greases is being marketed by Taft-Pierce Mfg. Co. to provide manufacturers and users of greases and bearings a means of determining the mechanical stability of heavy lubricants.

The machine works a definite amount of grease in a moderate sized bearing running at medium speed, at various test temperatures. While it does not indicate the lubricating value of the grease, it does give definite information on starting and running torque, oil separation, change in structure and consistency, channeling, leakage past bearing seals, aeration and the consequent increase in grease volume.

The unit is equipped with a constant-speed, 3450 rpm motor, on the spindle-extension of which is a plate-shielded SAE 204 bearing mounted in a grease cup which is free to turn. The grease is brought to a predetermined temperature which is recorded by a dial thermometer. Accessories consist of a grease-measuring cup, melting point apparatus, and the BEC penetrometer.

Panel-Pull Fuse Mounting

Fuses in aircraft line circuits or transmitters may now be instantly replaced with the aid of the new #1127 Panel-Pull Safety fuse mounting designed by Littelfuse Laboratories, Chicago, Ill.

The mounting uses the Aircraft Anti-Vibration 4 AG fuses, 1¼″ × 9/32″ diameter, which insures lasting service under severe conditions. The fuse is placed in the insulated knob holder (as illustrated) and then plugged into the panel.

RCA Radio Conversion Kit

Owners of original RCA aircraft receivers models AVR-7 and AVR-7A, may convert these sets into more modern equipment by utilizing the model AVA-9 conversion kit which features a new and improved remote control system.

The kit consists of a reversed-etched control panel mounting a new dial scale and pointer allowing easier reading of frequency and more accurate calibration. A new control box is mounted on the rear of this plate, using a 48:1 gear reduction which provides fine tuning, excellent resetability and negligible backlash.

A new volume control permitting improved control of signal strength, an improved band change control cable, headphone jack and a static limiter switch are also included. The panel is wired with a short cable terminating in a connector. A 10-ft. cable terminated at each end with a connector serves to connect electrically the control panel and the receiver.

A gear box, matching the tuning control head in ratio, is supplied for mounting on receiver case. The original remote mechanical tuning cable is used with new fittings supplied to accommodate the cable to the gear box and control head. This change eliminates set screws for locking the shaft and casing in place.

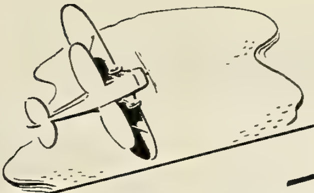
Installation is simple, the only mechanical work necessary being the mounting of the gear box, installation of new fittings on the remote tuning cable and removal of the old control panel and cables and the substitution of the new equipment.

Cable Tension Indicator

Accurate measurement and equalization of tension on small cables can be accomplished through the use of an instrument recently perfected by Martin-Decker Corp.

Weighing 17 oz. and having an overall height of 3.5″, the unit was developed at the request of an aircraft manufacturer who desired something that would allow determination of the tension on the many small cables used in aircraft construction. Army and Navy have found that it meets requirements for accuracy.

The instrument operates on the deflection principle. Actual tension is obtained by clamping it on the cable, where loads from 10 to 200 lbs., on cables up to 3/16″ diameter, can be measured quickly. The device is self-contained, automatically adjusted for temperature changes.



Refinement IN EVERY DETAIL

● Waco Airplanes are beautiful in appearance, outstanding in performance, and as completely comfortable as the finest motor car. From the exceptionally efficient 5-place S-6 Cabin at $4995, to the luxurious and high-performing C-6 Cabin, each model is designed with every consideration for the ease and convenience of pilot and passengers. Refinement in every detail, reliability and economy of operation keep Waco the favorite of the American sportsman, business executive and charter airplane owner.

THE WACO AIRCRAFT CO., TROY, OHIO, U. S. A.

WACO AIRPLANES
"ASK ANY PILOT"
WACO LEADS IN AIRCRAFT REGISTRATION

"PUMPS BY PESCO"

PESCO equipment on the new Douglas ships includes fuel pumps, vacuum pumps for instruments and gyro-pilot, and hydraulic pumps for operation of landing gear and flaps.

THE
PUMP ENGINEERING SERVICE CORP.
12910 Taft Avenue, Cleveland, Ohio, U. S. A.

Personairlities

by Caldwell

● Those students of human and near human nature who have marvelled at the ambition of young men of the present day to work around airplanes for almost anything, or even for nothing, may think that this youthful ardor is a new phenomenon, something induced by the publicity that aviation has received, or possibly by gazing enraptured at my good friend Colonel Roscoe Turner in his gorgeous uniform—a sight to unsettle anyone. There's nothing new about this youthful hankering for airplanes, however. Young men and boys of every generation have always had the habit of sneaking up on some unit of transportation and wiping it off, merely for the privilege of being near it and looking at it. The fact that the thing can move is what gets them; and it doesn't matter whether the movement is by land, sea, or air.

My grandfather, for instance, as a boy in the old stage-coach days spent hours washing and polishing a stage coach for no greater reward than permission to blow the horn. I think he was more than a trifle simple, though in my own youth I have wiped off a whole locomotive—an old wood-burner on a Nova Scotia jerk-line—in exchange for the boon of a ride out to the "Y" and back. Then there is the authentic record of my Uncle Cuthbert who, yearning to travel and see the world, worked his way from Buffalo to Albany on an Erie Canal boat. As his job was to walk along the tow-path and drive the mules, he might as well have walked alone and dismissed the mules and the canal boat from his mind as unnecessary complications. Still, he eventually ended up as a New York State Senator, so I suppose he found his companionship with the mules informative and helpful in his later political career.

All of which merely goes to show that boys in all generations are about the same. Pilot David Ellis Doty of American Airlines, Inc., is no exception to this rule. Although he had been fully educated at the University of Utah, he started in 1914 the standard washing and wiping process that is supposed to lead on to fortune. He washed an airplane belonging to a famous pilot of those days, Silas Christofferson. It almost instantly proved his undoing. Like every other youth who washes an airplane for a famous pilot, young Doty succumbed to the insidious influence, and begged to be allowed to wash that airplane once a week. The pilot of the youth-unsettler naturally agreed. So every week David Doty washed that airplane at Vancouver, Washington. So industrious was he that he came to the attention of the United States Army which, realizing the need for an enthusiastic airplane-washer in an Army that largely objects to such labor, invited Doty to come to San Diego and wash some of the planes at Rockwell Field.

After 14 years, Al (Pop) Croft and Dave Doty meet again in California

He did this so well that in 1918 the Army sent him to groom the equipment at Park Field, and later to Texas. By that time he didn't care if he ever washed another airplane; the novelty had worn off, along with considerable hide from his knuckles, for in those days streamlining was only a theory and airplanes were festooned with wires, fittings, and other external blobs among which the unwary washer would entangle himself. Meanwhile Doty was learning to fly and to leave the bathing of Jennies to the new crop of keen youths who were growing up to defend their country from the imaginary onslaught of the Germans of 1917, who probably wouldn't have got this far even if they had whipped the French and the English, as they seemed to be in a fair way of doing at the time. Incidentally, it occurs to me to wonder mildly at the enthusiasm with which many of us, including myself, speak and write about the defense of our country against some foreign enemy, when actually the most damaging enemies we citizens have encountered so far have been our own professional politicians. The gang we've had in for the past three years for instance have cost us more than the Germans ever did. We only had to *fight* the Germans; we have to *feed* this gang of bureaucrats, from Uncle Smiley right on down to Eugene Vidal which is getting pretty far down.

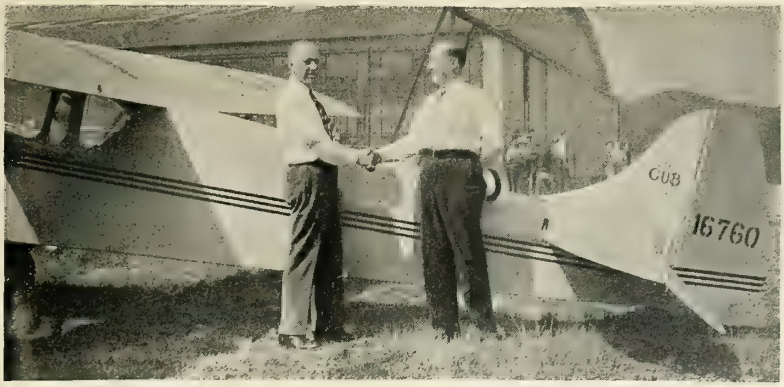
David Doty spent those merry months from August, 1918, to April of the following year, in France, defending his country and testing the native wines of the continent. He goes into no details about his war experiences except to state that he was there, so we may imagine him either shooting enemies or shooting craps—both merely time-wasting diversions for a sensible man, as most of us have since concluded. Unfortunately for world peace, this clear vision doesn't descend upon us until we're past forty, and too old to fight anyhow. I can imagine nothing more peaceful than two opposing armies composed entirely of men over forty. Of course, generals and colonels usually are over forty, but they don't fight themselves; they just say to someone else—some simple chap like Doty or myself—"Fight here," or "Fight there," and then sit back calmly and see how we make out. That is, *if* we make out. War is a whole lot of fun for generals and colonels and J. P. Morgan & Co.

For two years following April, 1919, Doty was with the U. S. Army in the Philippines, where he was detailed to construct what is now Clark Field, near Manila. The Japanese will probably find this field useful when they capture the Philippines, as they will do eventually. I believe the only reason the Japs haven't taken those islands long ago is because the United States is the largest buyer of Japanese silk; and the Japs have preferred not to punch a good customer in the nose. Those silk worms saved us trouble. Now we're giving the Philippines their independence and General Douglas MacArthur, both of which I'm sure they'll find equally valuable. It seems that to defeat the Japanese you merely have to fight better than the Japanese; that's what's puzzling the Chinese. As I've indicated before, however, China's solution will be to let the Japs win, then marry them. In two generations they'll all be Chinamen. That sort of thing has been going on for

(*Continued on page* 86)

● SEE THE "CUB" AT THE NATIONAL AIR RACES ●

Life begins at 16 and 60 with the *New* "CUB"



The Charter Members of the "Flying Grandfathers" and the New CUB.

Improvements on the *New* "CUB"

Newly designed throughout
Gracefully streamlined
Beautifully finished
Better, Easier Control
Higher Top Speed
Higher Cruising Speed
Improved Engine Mounting
Finer, Smoother, "balanced" Performance
More Stability
More and better Visibility
Wider, sturdier Landing Gear
Insert Ailerons
Gracefully rounded Wing Tips and Tail Surfaces
Improved Cowling and Windshield Arrangement
New Type Instrument Board
Larger, Roomier, Tightly Sealed Cabin
Larger, more comfortable Seats
Baggage Compartment behind rear seat
More than ever the World's Biggest Airplane Value

WHAT better proof of safety with performance can there be when children of ten . . . and men of 60 and 70 learn to solo and can enjoy daily flying after only a few hours of instruction?

Only recently organized by two Bradford grandfathers who quickly learned to fly in a CUB, the membership of the "Flying Grandfathers" is growing fast. And, oddly enough, each new member proves to be a CUB enthusiast.

No other airplane has ever done so much to popularize flying; no other plane has ever offered the average citizen the opportunity to fly, day after day, safely, economically and comfortably.

Here then, is the airplane that anyone and everyone can fly.

When the CUB operates for less than the lowest-priced cars, who is there who can't afford to fly? The New CUB offers flying to everyone, old and young; it also offers to ambitious young men the most promising career of all—Aviation as a life's business. Life begins at 16 and 60 with the New CUB.

TAYLOR AIRCRAFT CO., No. 9 D Street, BRADFORD, Pennsylvania

YOU PAY ONLY
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CASH
Balance in Easy Monthly Payments

We teach you to Fly FREE

PRICE $1470 F. A. F
With Enclosure

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DIGEST OF THE NEWS

AIR SERVICES

Planes, Engines Ordered

Award of a contract for 50 additional Stearman PT-13 primary trainers for the U. S. Army Air Corps brings the total of this type purchased for Army and Navy use during the past two years to 137. Newest order involves $329,659, exclusive of engines, propellers, instruments, etc., and will be delivered when the last of 26 ordered previously has been accepted.

PT-13 is a two place biplane powered by a 225 hp Lycoming R-680-5 engine.

* * *

Three high performance single-place pursuit ships, known as Y-1-P-36 were purchased from Curtiss Aeroplane & Motor Corp., as a result of tests completed at Wright Field. Army service tests will be continued on the new planes which are all-metal low-wing monoplanes mounting a 900 hp engine equipped with controllable pitch propeller.

* * *

Contracts involving $1,327,190 were signed by Wright Aeronautical Corp., and U. S. Army Air Corps for 150 Series G Cyclone engines for use in twin-engined bombers now being manufactured by Douglas Aircraft Co., Santa Monica, Calif. These are the engines which deliver 1000 hp at take-off.

Mitchell Race Date Set

Lieut. Col. Ralph Royce, commanding Selfridge Field, selected October 17 as the date for the Mitchell Trophy Race at Selfridge Field. Greater speeds are expected to be attained this year, as the First Pursuit Group is now equipped with the new Consolidated PB-2's.

Last year, the winner of this contest, the late Capt. Karl G. E. Gimmler, piloting a Boeing P-26A averaged 212.6 mph over the 100-mile course. There were ten Air Corps pilots in the competition.

Summer Training

Annual summer training classes for army reserve pilots from the Southwest is under way at Hensley Field, army airport at Dallas. Classes consist of theory and actual flying. Capt. Bernard Thompson is commander at the field and during training sessions is assisted by regular army officers including many pilots from Randolph and Brooks fields. Reserve officers are on hand from Texas, New Mexico, Colorado, Arizona, Oklahoma, Arkansas and Louisiana.

Airdrome Work

Kelly Field's new night lighting system is rapidly being installed, augmenting the present system by an installation of three Type 9-A floodlights, one of which is installed at the west end of the NW-SE runway. Another replaces the old floodlight at the southwest edge of the field, and the third, the one in front of the present Post Operations Office. In addition, there is a new wind tee which has automatic control settings, and a new system of signal lights for night flying control with its necessary cabinet controls located in the night flying control tower and Post Operations office.

* * *

Announcement has been made of the approval of a $370,000 WPA project, which calls for extensive improvements at Hensley Field, army reserve field, at Dallas. Approved allotment provides for construction of additional runways, grading and other minor conditionings. Plans are proceding in contemplation of approval of a $6,000 army grant, and a PWA application for a project total of $70,000.

Newest Grumman for the U. S. Navy, some of which are now based on the "Lexington"

* * *

$150,000 will be spent for improving the Sand Point Naval Air Station in Seattle during the next six months. Capt. R. M. Warfield, Navy, announced work will include a new administration building costing $63,000; a $70,000 barracks extension and miscellaneous repairs amounting to $17,000. The Sand Point project is part of a $725,000 construction program for the 13th Naval District.

* * *

Work has been started on the new concrete apron for the hangars at Scott Field, Belleville, Ill. This apron will be approximately 1,000 ft. long by 100 ft. wide. It will have a concrete drain along the landing field side and will be equipped with three airplane wash racks and a number of refueling pits.

A landscaping project along the west side of Scott Field, adjacent to the new State highway, is practically completed. To date, 200 elm trees and 1000 shrubs of various kinds have been transplanted.

* * *

An appropriation of army funds to be used for improvements at Hensley Field, army reserve field in Dallas, provides for the construction of five service pits, in addition to two 25,000-gallon auxiliary tanks. An approved WPA application provides for more extensive improvements, including more runways and repairs to buildings. Construction of additional buildings is planned at some future date.

* * *

The War Department has installed a radio beam at Maxwell Field, Montgomery, Ala., at a cost of $45,000. It was ready for operation July 1, and has a radius of 200 miles.

New Cadets

Newest class at Primary Flying School, Randolph Field, Texas, numbering 132 students, comprises 10 Air Corps officers, who hold lighter-than-air ratings; 5 officers of other branches of the military service; 22 enlisted men of the Regular Army, and 95 civilians. Enlisted and civilian students undergo flying training under the status of Flying Cadets.

* * *

Initial placement of Naval Aviation Cadet Corps men took place last month when 35 reserves completed training at Pensacola Naval Air Station and were assigned to regular service in aircraft squadrons with the Fleet. Nine of these, together with seven Marine Corps Reserve cadets were commissioned Second Lieutenants, Marine Corps and assigned to Marine aviation squadrons.

These cadets were among the first class of candidates selected in July, 1935 in the establishment of the new corps. After three years with the Fleet, they will be released from active duty and commissioned ensigns in the Naval Reserve.

At present 494 cadets are in training at Pensacola and each month a group will be graduated and follow this class to the fleet. Cadet training is being continued on the same basis of inducting one class each month. It is planned to provide about 250 pilots for the Fleet from candidates selected during the fiscal year 1937.

TC-13 Test Flights

TC-13 airship at Moffett Field, Calif., recently completed two test flights, the first consisting of a harbor watch mission off San Francisco Bay, operating at the speed of surface craft. Indicated endurance of the ship was 150 flying hours.

Second test was conducted at a cruising speed of 65 mph. A distance of 1855 miles was logged. Fuel remaining at the time of landing was sufficient to have projected this flight to a total of 2500 miles.

(*Continued on following page*)

BABB AIRCRAFT SALES

INTERNATIONAL AIRCRAFT BROKERAGE • U. S. EXPORT LICENSE NO. 124

ENGINES:

CYCLONES, Model SR1820-F2, new, 735 H.P. List price $8120; net each.	$6000
CYCLONE, Model SR1820-F52, 820 H.P. Same as new. List price $8600; net	6000
CYCLONE, Model SR1820-F1, 650 H.P. Practically new	3000
HORNETS, Model 1860B, geared, 575 H.P. 38 hours total time. Each..	1000
HORNETS, Model 1860B, direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each	1650
HORNETS, Model 1690A, 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each	1000
WASP SC1's—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each....	1650
WASP C's—420 H.P. Under 500 total hours; overhauled and modified. Each	1350
WASP B's—420 H.P. Under 600 total hours; overhauled and modified. Each	850
WRIGHT R975-A's, with D modifications — 330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each	1250
WRIGHT R760-E's — 250 H.P. Majored and modified by Wright distributors. Each	1250
WRIGHT J-5—220 H.P. 593 total hours, standard cylinders, majored—like new	450
LYCOMING R-680—215 H.P. Majored and modified by Lycoming distributors	550
KINNER B-5—125 H.P. Newest type; factory rebuilt, with new engine guarantee	850
KINNER R-5—160 H.P. Few total hours—like new	850
KINNER K-5—100 H.P. Front exhaust. Same as new	650
KINNER C-5—210 H.P. Under 400 total hours; majored and modified.	450

SPECIAL

While They Last!

New, genuine Wright J-6 Exhaust Valves, each..	**$12.50**
J-5 Exhaust Valve Guides, standards, each....	**1.50**
J-5 Exhaust Valve Guides, plus tens, each....	**3.00**

Following Engines in "As Is" Condition All average under 500 total hours:

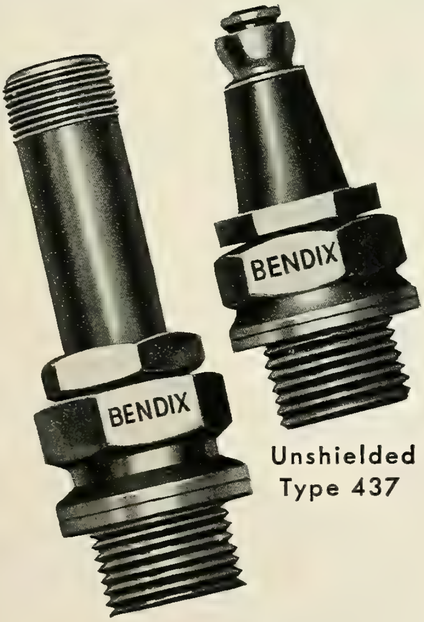
No.	Type	Price Each
27	**HORNET A-1's**—525 H.P.	$500
18	**HORNET B's**—575 H.P.	850
25	**WRIGHT R975's**—330 H.P.	675
40	**CURTISS D-12's**—400 H.P.	500
18	**CURTISS CONQUERORS** — 600 H.P.	500
3	**AXELSONS**—150 H.P. 7 cylinder, air cooled	150
1	**CHALLENGER**—185 H.P.	195

AIRPLANES:

Aeroncas, Bellancas, Boeing, Curtiss Wright, Eaglerocks, Fairchilds, Fleets, Fleetsters, Fords, Lockheeds, Northrops, Pitcairn, Stearmans, Stinsons, Travel Airs, Wacos and others.

Engine parts—new and used—for Wasp and Wright engines at big discounts. Write for bulletin on bargains.

CHARLES H. BABB • GRAND CENTRAL AIR TERMINAL • GLENDALE, CALIFORNIA



Unshielded
Type 437

Shielded
Type 7PJ

BENDIX H·T SPARK PLUGS

For Aircraft Engines

SCINTILLA MAGNETO CO., INC.

(Subsidiary of Bendix Aviation Corporation)

SIDNEY, N. Y.

(Continued from preceding page)

Services at Oakland

With recent abandonment of Crissy Field, at the Presidio of San Francisco, Army Air Corps of 12th District, under command of Capt. George E. Henry now quarters at Oakland, Calif. Air Field where its various planes are domiciled. U. S. Navy under Lieut. Comdr. Ragsdale, is also using one of the large hangars there for his squadron's planes.

GHQ Field

Mitchel Field, Army Air Corps field near Hempstead, N. Y., passed from control of Commanding General, Second Corps Area, and became an exempted station as part of GHQ Air Force. Only 97th Observation Squadron and 14th Photo Section with station at Mitchel Field, remain under control of the Second Corps Area Commander for purposes of tactical training and employment. Lieut. Col. Walter H. Frank, Air Corps, is commanding officer of newly designated exempted station.

Personnel Changes

Important event at Advanced Flying School, Kelly Field, was departure of Col. Jacob E. Fickel and arrival on post of his successor as commanding officer, Lieut. Col. Arnold N. Krogstad. Originally slated to go to the Panama Canal Zone, change in orders sent Col. Fickel to Corps Area duty at the 9th Corps Area.

* * *

Col. Henry B. Clagett has been assigned to duty at Selfridge Field, Mt. Clemens, Mich., to assume command of the First Pursuit Group.

* * *

Col. Frederick L. Martin, Maj. Lawrence P. Hickey and Capt. John W. Monahan are on temporary duty in the Office, Chief of the Air Corps.

SCHOOLS

Activities

Students of Lawrence Institute of Technology, Highland Park, Michigan, tested a two-place glider which will be used for soaring at Sleeping Bear Point next summer. This is the third glider built at the school under the direction of Curtis L. Bates, professor of Aeronautics.

* * *

Outstanding graduates of the Curtiss-Wright Technical Institute of Aeronautics, will be designated honor students, according to C. C. Moseley, president of the Institute. Some of the graduates have been so outstanding in their work during their undergraduate days, that instructors felt their accomplishments should be recognized. Recognition of the student's outstanding ability will now be made by a designation on the student's diploma.

* * *

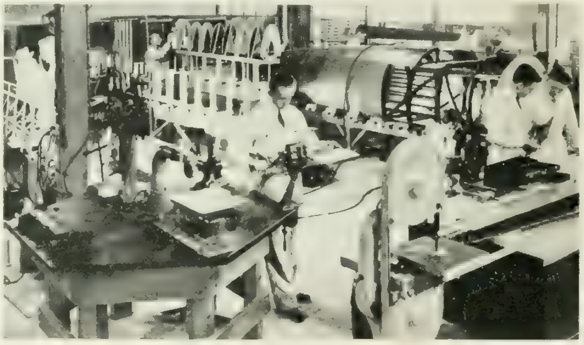
The proposed airport at Tuscaloosa, Ala., may be used by the school of aeronautics of the University of Alabama. The Tuscaloosa Commission Board recently decided to buy 240 acres as a site for an airport and offered part of it to the University.

* * *

Largest mass-country flight this year was completed by the Dawn Patrol of Spartan School of Aeronautics when 12 planes carrying 36 students and instructors flew to Dallas where they spent two days before returning to Tulsa.

Enrollments

Twelve new students enrolled in the Summer term beginning July 1 at Parks Air College, making a total registration of 201. New enrollments by schools follow: Engineering 5; executive transport 2 and master mechanic 5.



Part of the Boeing School shops where the new course in sheet metal working is given

* * *

Enrollment at Curtiss-Wright Technical Institute of Aeronautics reached all time peak with enrollment during the first six months of 1936 topping total enrollment of 1935 by three students. During June three times the number of students were enrolled that enrolled in the Institute during the same month last year. July enrollment also reached a new high, figures nearly doubling the former peak month and more than trebling average monthly enrollment during 1935.

* * *

Aeronautical engineering department, Mississippi State College, expects to have more than 150 students enrolled for either the Aeronautical Engineering or the Commercial Aviation courses this Fall.

New Course

Boeing School of Aeronautics is now offering an Airline Dispatching and Meteorology Course which requires nine months to complete. Lectures are given for 624 hours and 672 hours are spent on laboratory work.

Personnel Notes

Appointment of Walter Balch to the position of chief ground school instructor at the Ryan School of Aeronautics was announced by Claude Ryan, president. Balch was formerly chief of engine instruction at the school.

* * *

Grand Central Flying School's instruction staff at Glendale, Calif., was augmented by the addition of Rufus March.

* * *

New faculty members of Curtiss-Wright Technical Institute of Aeronautics are C. A. Bosserman, chief engineering instructor, and John Roth, instructor in blue print reading and shop mathematics in the Master Mechanic's school.

PRIVATE FLYING

Miami Races

Ninth Annual Miami All-American Air Maneuvers will be held at the Municipal Airport Dec. 10-12, inclusive, in conjunction with an outdoor aircraft show which will open Dec. 6 and continue without interruption until the races are concluded. Space at the show will be offered free of charge.

Events will include a women's race, starting in Georgia and ending in Miami, the first day of the meet. Other features will be a flight of at least 25 Taylor *Cubs*, and another of a group of Aeroncas, the first starting somewhere in the Carolinas, and the second from an eastern city. In addition there will be special races for these two type ships and another tour to Miami from the new Asheville-Hendersonville airport under the direction of Dr. J. E. Owens.

The day after the closing of the Miami meet, the Republic of Cuba will sponsor a race to Havana.

New Flight Rules

Instrument ratings for non-airline pilots, indicating they have met requirements and passed flight tests in aerial navigation by reference to instruments and radio, are provided for in new amendments to Air Commerce Regulations.

Amendments became effective August 15 and apply to non-airline pilots engaging in non-scheduled instrument flying along the airways in adverse weather. Under regulations previously announced, pilots who wish to make instrument flights through or over clouds along the civil airways are required to have demonstrated ability to do so, to have the necessary equipment in their planes, to furnish flight plans in advance and to report their progress by radio. The instrument rating is evidence that the pilot has met the Bureau of Air Commerce requirements with respect to experience and training.

To qualify for the rating, the pilot must hold a transport, limited commercial or private pilot license, have 200 hours of solo time, and a minimum of 20 hours' instrument flying instruction and practice.

In addition, he is required to pass a flight test while seated in a hooded cockpit and depending on instruments and radio in navigating the airplane. He will be required to navigate in straight level flight, in moderate banks making 180° and 360° turns in both directions, in minimum glides, maximum climbs and approaches to stalled attitudes of flight, climbing turns and recovery from stalls, skids, slips, spirals and banks in excess of 45°. Also, he will be tested in tuning his radio equipment and in using radio for orientation. He will be checked in following the course marked by the radio range beacon, in locating the cone of silence over the transmitting station, and in letting down to safe altitude while flying on the radio range course.

Ratings will be noted on the pilot's license. For a transport or limited commercial pilot, whose license has to be renewed each 6 months, the instrument rating will

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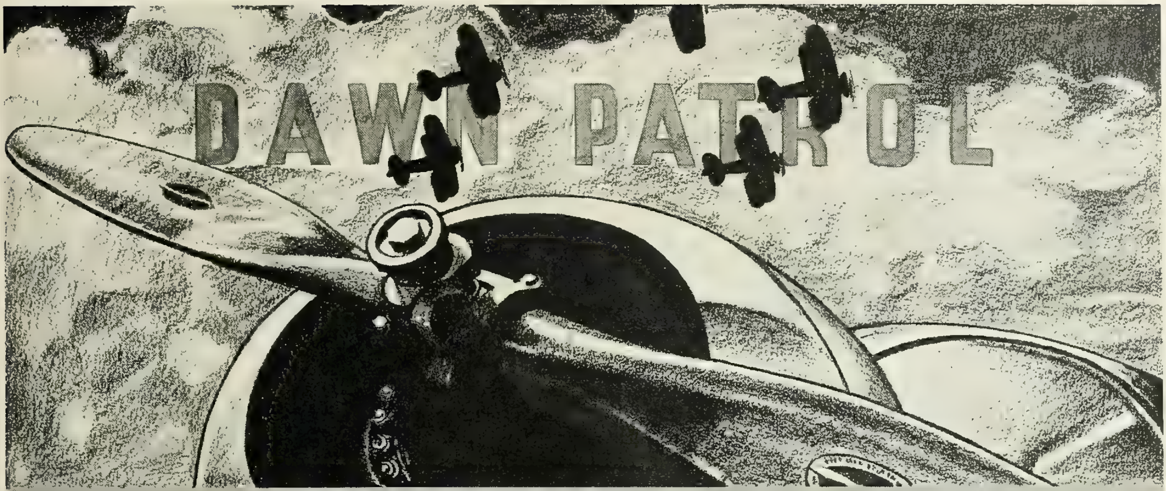

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(*Continued from preceding page*)

be renewed if he has had two hours of instrument flying practice within 6 months preceding the expiration date of the license. For the private pilot, whose license is renewable each year, the instrument rating will be renewed if he has had four hours of instrument flying practice within the year preceding the expiration date of his license, including two hours within the last 6 months.

The new rating does not apply to scheduled airline pilots who are governed by special regulations and have an SATR.

Flight procedure has been changed in conformity with the new rulings. Eastbound planes are required to fly at odd altitudes, and westbound planes at even altitudes. Planes crossing an airway must fly at altitudes halfway between those for west and east bound planes.

AIRPORTS

Improvements

Buffalo, N. Y. Leveling, grading, draining; $300,000. WPA project.

Chesapeake, Ohio. Huntington-Ironton Airport; drainage, grading and filling, two concrete runways, measuring 3500 ft. and 2100 ft.; $85,000. WPA project.

Claremore, Okla. Conditioning 40 acres additional ground; $4430 WPA funds, $319 city.

Columbia, Mo. Municipal airport; station house and waiting rooms; $2403. WPA and city project.

Dallas, Texas. Love Field; administration building, completion of runways, landscaping.

Hastings, Neb. Installation of night lighting equipment including 8 floodlights, boundary and obstruction lights; graveling runways and aprons; grading; administration building; $20,000 WPA funds, $1600 city.

Joplin, Mo. Resurfacing and drainage of runways, $55,566; new hangar and grading, $8750. WPA and city project.

Lawton, Okla. Leveling, boundary lights, lighted wind indicator, repairs to buildings, treatment of runways, landscaping; $10,550 WPA funds, $1790 city.

Miami, Fla. Municipal Airport; extension of area on 1000 additional acres; new runways; resurfacing of old runways and aprons.

Minneapolis, Minn. Wold-Chamberlain Field; three new concrete runways—3000′ × 150′ N-S, 3000′ × 150′ NE-SW, 3500′ × 150′ NW-SE; $200,000 WPA funds, $50,000 city bond issue.

Nevada, Okla. National Guard Airport. Extension of airport, $17,132. WPA project.

New Philadelphia, Ohio. Contract for 12-plane hangar let to Wandling Bros., Dover, Ohio; $18,575. City project.

Oklahoma City, Okla. Municipal Airport; new hangar for U. S. Army Air Corps Reserve; $75,711 WPA funds, $13,041 city.

Poplar Bluff, Mo. Drainage, fencing, runways, $13,091. WPA and city project.

St. Joseph, Mo. Complete reconstruction, $144,183. WPA project.

St. Louis, Mo. Lambert-St. Louis Field; marker lights, wind indicator, $9657. WPA and city project.

San Francisco, Calif. Mills Field; administration building; $141,799.

Tulsa, Okla. Municipal Airport; runways, drainage, grading, lighting system; $63,000 federal funds, $3225 WPA.

Personnel Notes

Transfer of Mel N. Burns from Mills Field, San Francisco, to Burbank, Calif., has been announced by Palmer Nicholls, president of Pacific Automotive Corp.

Malcolm Wallace joined Grand Canyon Airways, Boulder, Colo., as co-pilot.

Cordova Airways, Cordova, Alaska, employed Chester Martin in the capacity of chief mechanic.

Joe Duncan is now with Bennett Flying Service, Sacramento, Calif., where he is instructing and piloting.

The expansive policy pursued by Nicholas-Beazley Airplane Co., has resulted in the employment of Kenneth E. French, who joined the sales department as traveling representative; W. C. Whitehead, who is also with the sales department, and C. E. Reid, formerly of Sikorsky, who has been added to the purchasing department. In addition to these acquisitions, Nicholas-Beazley announced that John M. Henkel is now traveling the Eastern territory for the company.

Tulsa Shows Profit

Operating profit for the year ending June 1936 of the Tulsa Municipal Airport was $1,339.51 with an investment in the airport of $550,000. This airport has shown a profit since its inception, the high mark being $11,436.65 in 1932. Greater source of income was from fuel and oil sales, these representing 43% of the total income of $16,962.85; field operations brought 31%; storage 20%, and concessions 6%. Operation cost of the field for the year was $15,623.34.

* * *

Cost to the city of Omaha, Neb., of the municipal airport has been reduced in the last three years from $15,000 to $5000 annually. Finance Commissioner Knudsen promises the field will be put on a self-sustaining basis within two years.

AIRLINES

Ticket Offices

TWA and Chicago & Southern Airlines moved their downtown ticket offices to 401 North 12th Boulevard in St. Louis.

* * *

Pacific Alaska Airways opened new offices at 1324 Fourth Ave., Seattle, with A. B. Hayes in charge.

* * *

Martin and Newbold, Inc., established an office in downtown Boston with the idea of combining into one office an Air Travel Service and an Airplane Sales Organization. The Air Travel Service features exclusively airline tickets and charter service.

* * *

Delta Air Lines moved its Dallas ticket office to larger quarters, and now shares space with American Airlines in the Baker Hotel.

Air Tours

Pan American Airways has arranged for the operation of a trial series of sixteen all-expense, all-inclusive Flying Clipper Cruises, to Rio de Janeiro, designed to fit into the average vacationist's limited two and three week holidays.

Due to faster schedules recently inaugurated over the eastern route through the West Indies to Brazil and Argentina, the cruise to Rio (which requires twelve days by steamer) will be made in just over four days of flying. The Martin clipper type ships will carry thirty-two passengers, a regular flight crew of four, and a purser and steward who will act as guides aloft and ashore.

Travelers have a choice of two cruise schedules, both over the same route. The first is a 14-day trip, allowing three days in Rio de Janeiro and one day in Trinidad, on the southbound flight. The second cruise provides the same stopover in Trinidad and ten days, instead of three, in the Brazilian capital. On this longer cruise passengers will have the opportunity to continue on to southern Brazil, to Montevideo, Uruguay and Buenos Aires in the Argentine. Fare for the two weeks' cruise has been set at $665 and for the three weeks' cruise $695, including all expenses from and back to Miami.

Expansion

A $2,500,000 equipment purchase and improvement program was announced by Transcontinental & Western Air, Inc. Principal items include an appropriation of $1,950,000 for construction of the nucleus of a fleet of new and larger transports, development and research work in four-engined transport planes, and experimentation in overweather flight with specially designed equipment; investment of $350.000 in conversion of its present fleet of Douglas aircraft to a higher horsepower; and $200,000 for additions to present equipment, airport improvements and other facilities.

TWA engineers have been working for the past eight months in conjunction with Douglas Aircraft Corp., creating a design for a new transport airplane. It is expected this entire fleet will be in service within six months.

* * *

First Douglas DC-3 for United Air Lines was scheduled for delivery the first of this month, the plane being powered by 1150 hp. P & W 2-row Wasp engines and carrying 14 passengers in a de luxe cabin with large, adjustable and fully reclining seats. In addition 2800 lbs of cargo will be accommodated. The following nine to be delivered will be similar, but the next five will be the conventional 21-passenger type.

97,453 Passengers

Twenty-one scheduled airlines in the United States carried 97,453 passengers and 701,142 lbs. of express, and flew 40,252,357 passenger miles during June, 1936, bringing totals for the first six months of 1936 to 421,587 passengers, 2,911,775 lbs. of express and 179,509,746. The lines also flew 5,619,896 miles during June.

In June, 1935, the 22 companies operating at that time carried 73,896 passengers, 330,970 pounds of express, and flew 31,225,699 passenger miles, 186,310,017 express pound miles, and a total of 4,993,328 miles.

During June of this year 68% of available seats were occupied, as against 60% for June 1935.

* * *

For the fifth consecutive month Central Airlines reported an increase in passenger traffic, July figures being 31% over June, and 466% over July 1935. During July, Central carried 3246 passengers and flew 128,155 miles, representing 97.6% of miles scheduled.

* * *

Popularity of American Airlines' new fleet of Douglas flagships, flying non-stop between Chicago and New York, was proved by their performance during the first month of operation, according to C. R. Smith, president.

Operating twice daily in each direction and covering 92,460 miles, while carrying 1,447 revenue passengers, they averaged 195.5 mph and carried an average of 87% of their passenger capacity.

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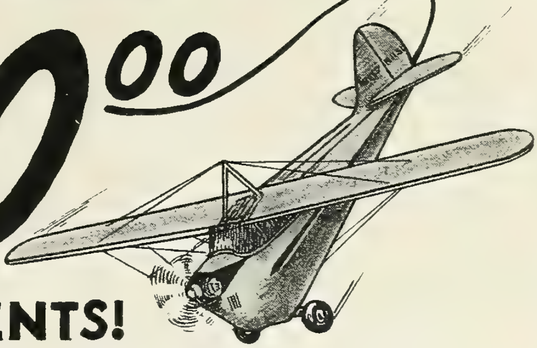

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SAFETY CHUTES
SWITLIK PARACHUTE & EQUIPMENT CO. TRENTON, N. J.

(*Continued from preceding page*)

Best time eastward was 3 hours 34 minutes, averaging 218 mph; westward time was 3 hours 59 minutes, a new record for the run.

* * *

Record passenger, mail and express loads were carried during July by National Parks Airways, passenger revenue showing a 96% increase over July 1935 and a 63% increase over the previous record month of June 1936. Mail poundage flown during the month showed a 14% increase and express shipments were 55% ahead of July 1935.

* * *

A new record was set for travel out of the Chicago Municipal Airport in July when 13,376 passengers departed on the seven lines using the field, an increase of 29% as compared with the previous record set in July 1935.

* * *

Setting an all-time record of 24,407 revenue passengers transported on its system during July, United Air Lines exceeded the 100,000-passenger mark for the year and assured its goal of better than 200,000 for 1936. The July mark represented an increase of 20% over the 20,341 passengers in July last year, and a gain of 11% over the 21,801 passengers in June, 1936. During the first seven months of this year, United transported 116,234 revenue passengers.

Trans-Pacific Base

San Francisco Board of Supervisors authorized lease to Pan American Airways of Mills Field for basing trans-Pacific Clipper Ships. Several thousand men are now employed reclaiming tide lands near South San Francisco, and in dredging channels leading to Mills Field, on which will be erected permanent buildings and facilities required for the service.

Radio Stations

Seven new radio stations to replace former facilities used for radio telephonic communication with its planes are being installed by Pennsylvania Airlines at Washington, Pittsburgh, Akron, Cleveland, Detroit, Grand Rapids, and Milwaukee. Equipment includes latest RCA models. The system operates through all atmospheric conditions on a single frequency, making possible simplicity of construction and operation.

Scenic Flights

Yellowstone National Park, Grand Canyon and Boulder Dam and Lake may be visited by travelers on a special summer weekend tour with United Air Lines. Planes leave eastern cities on Friday night and return early Monday morning.

Passengers reach Las Vegas, Nevada, after an overnight flight from the east and then can choose one-day combination air and boat trips. Leaving Las Vegas, Saturday evening, they reach Salt Lake City for an overnight hotel stop. The air tour is resumed Sunday morning with a flight to West Yellowstone airport for transfer to a multi-motored sightseeing plane making a 1 hour 30 minute scenic circle flight over the entire park as well as Grand Teton National Park and Jackson Hole country.

Leaving Yellowstone by plane Sunday afternoon, tourists make a return overnight flight to the east, reaching principal eastern cities before breakfast Monday morning.

Personnel Changes

Appointment of Miss Marie C. Sullivan as head of the newly established women's department of Eastern Air Lines was reported by Capt. E. V. Rickenbacker, general manager of the company.

* * *

C. Bedell Munro, president of Pennsylvania Airlines and Transport Co., announced the election of Frank R. Phillips, president of the Philadelphia Co., and Ralph S. Richards, president of Kay Richards & Co., to the company's board.

American Airlines

Election of Melvin D. Miller to the office of vice-president in charge of sales, was announced by C. R. Smith, president. Miller, who has served as general sales manager, was also named to the Board of Directors.

James C. Flynn has been appointed superintendent of communications, taking charge of radio, telegraph and teletype communications over the entire route of the system.

United Air Lines

Keith L. Becraft, formerly at Iowa City, has been appointed station manager at Cedar Rapids, Iowa.

Charles Eshleman, passenger agent at Cheyenne, is now chief passenger agent at Chicago.

Donald MacDonald of the general accounting department at Chicago was appointed traveling auditor.

J. S. Anderson, formerly station manager at Lincoln, has been transferred to Omaha as dispatcher. James Moore became Lincoln station manager.

Schedule Revisions

Addition of a fifth round-trip passenger schedule, offering fast through service on the Washington-Detroit airway, with stops at Pittsburgh, Akron and Cleveland, was announced by D. Walter Swan, vice-president in charge of traffic for Central Airlines.

* * *

Additional service between Dallas, Houston and Galveston has been provided by Braniff Airways to meet increased travel demands to and from the Texas Centennial Exposition.

* * *

Traffic in and out of Oklahoma City and Tulsa, Okla., has become so heavy that second sections will be part of two regular schedules in the future, according to M. E. Wilkerson, division sales manager for American Airlines. Special sections will be run on the southbound afternoon schedule, which leaves Chicago at 1 pm and Oklahoma City at 6 pm, and the northbound schedule which leaves Fort Worth, at 12:24 pm.

* * *

Northwest Airlines inaugurated fifth daily round-trip schedule between the Twin Cities and Chicago. Departure from St. Paul is 3:15 pm and Chicago arrival 5:50 pm. Return flight starts at Chicago at 2 pm, with arrival in St. Paul at 4:30 pm. Curtiss-Reynolds airport in north Chicago is now a flag stop on one trip each way daily.

* * *

Features of the new United Air Line schedules include addition of a sixth daily round-trip coast-to-coast flight, making the third overnight schedule across the continent. An eleventh daily round-trip was scheduled between Los Angeles and San Francisco, a twelfth daily round-trip between Chicago and Cleveland and an eleventh flight between New York and Chicago. Cedar Rapids, Iowa, was added as a flag stop following expansion of airport facilities there.

* * *

Earlier morning service for northern New England communities was provided when schedules were advanced on both lines of Boston-Maine—Central Vermont Airways. New schedules show that on the Maine line planes leave Boston for Bar Harbor daily at 8:55 am with arrival in Portland at 10:00 am; Augusta 10:35; Waterville 10:50; Bangor 11:15 and Bar Harbor 11:50 am. Westbound planes leave Bar Harbor daily at 3:55 pm; Bangor 4:30; Waterville 5:00; Augusta 5:15; Portland 5:55, arriving in Boston at 6:55 pm.

* * *

Seven non-stop flights in each direction on week days and on Sundays, with stewardess service, is now flown between New York and Boston by American Airlines with new Cyclone-powered Douglas DC-3's. Northbound time for the run is 1 hour 18 minutes; southbound against prevailing winds, 1 hour 24 minutes. In addition, three local services with three flights each way on week days and two on Sundays, stopping at Hartford, Providence and New Haven, are offered.

ASSOCIATIONS

The Sixth Annual Convention of the National Association of State Aviation Officials will be held Sept. 23-26 inclusive at Hartford, Conn., with headquarters at the Hotel Bond. The tentative program of the meeting includes inspection trips to the Pratt & Whitney and Hamilton Standard Propeller factories, addresses by F. B. Sheriff, Montana Commissioner of Aeronautics; J. E. Hoskins on *Aviation Insurance;* C. R. Smith, president of American Airlines on *Airlines and State Aviation Regulation;* and J. H. Geisse, Dept. of Commerce on *Probable Aircraft Trends in the Near Future.* Round table discussions will be held on airports, and federal and state cooperation. The meeting will close with an informal luncheon.

New Jersey

More than 70 members of the New Jersey State Aviation Association met for the third time August 6 at the Robert Treat Hotel, Newark, N. J., for an informal discussion of new and old business during which it was announced that more than 80 new members were enrolled since the previous meeting in July. The meeting was addressed by George J. DeGarmo, of Standard Air Service, Inc., on the subject of aerial photography.

It was decided that the Board of Governors, which consists of the executive officers and county directors, should meet later in the month for the purpose of drawing up a tentative program to follow during the coming year.

THE INDUSTRY

Aircraft Meeting

Details of the National Aircraft Production Meeting of the Society of Automotive Engineers to be held Oct. 15-17 inclusive at the Ambassador Hotel, Calif., indicate attention will be focused on spot welding advancements, new methods of tooling and fabrication of aluminum, and the advantages of aluminum alloy forgings over other types of materials and constructions.

Among papers to be read at the meeting are those being prepared by C. H. Monteith (Boeing), A. E. Raymond (Douglas), G. H. Prudden (Lockheed), J. C. Ward, Jr. (Pratt & Whitney), A. L. Beall (Wright), C. H. Schildhauer (Pan American Airways) and John Tyler (Lycoming).

There will also be prepared discussions on each paper and open discussions will be invited from the floor.

(*Continued on following page*)

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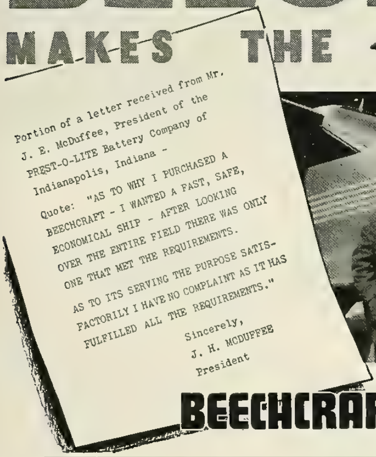

Portion of a letter received from Mr.
J. E. McDuffee, President of the
PREST-O-LITE Battery Company of
Indianapolis, Indiana -

Quote: "AS TO WHY I PURCHASED A
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ECONOMICAL SHIP - AFTER LOOKING
OVER THE ENTIRE FIELD THERE WAS ONLY
ONE THAT MET THE REQUIREMENTS.

AS TO ITS SERVING THE PURPOSE SATISFACTORILY I HAVE NO COMPLAINT AS IT HAS
FULFILLED ALL THE REQUIREMENTS."

Sincerely,
J. H. MCDUFFEE
President

Typical of executives everywhere who consider the BEECHCRAFT an indispensable part of their business day, this letter of Mr. McDuffee, President of Prest-O-Lite, sums up in less than fifty words the reason for BEECHCRAFT leadership—*speeds that make other forms of transportation obsolete.* BEECHCRAFT'S have changed the clock, trips formerly taking days and often weeks are reduced to hours and minutes. Slow landing speeds and safety features make BEECHCRAFT an exceptionally easy airplane to handle, yet with spectacular speeds, maneuverability and performance BEECHCRAFT'S *match motor car economy* with large pay loads and long cruising ranges, more than eleven miles per gallon being the amazing day in, day out performance of the Model C17L. Send for the new catalog, giving full specifications and performance data on BEECHCRAFT Models C17L, C17B and C17R—*the airplanes that are writing new transportation history in air travel throughout the world.*

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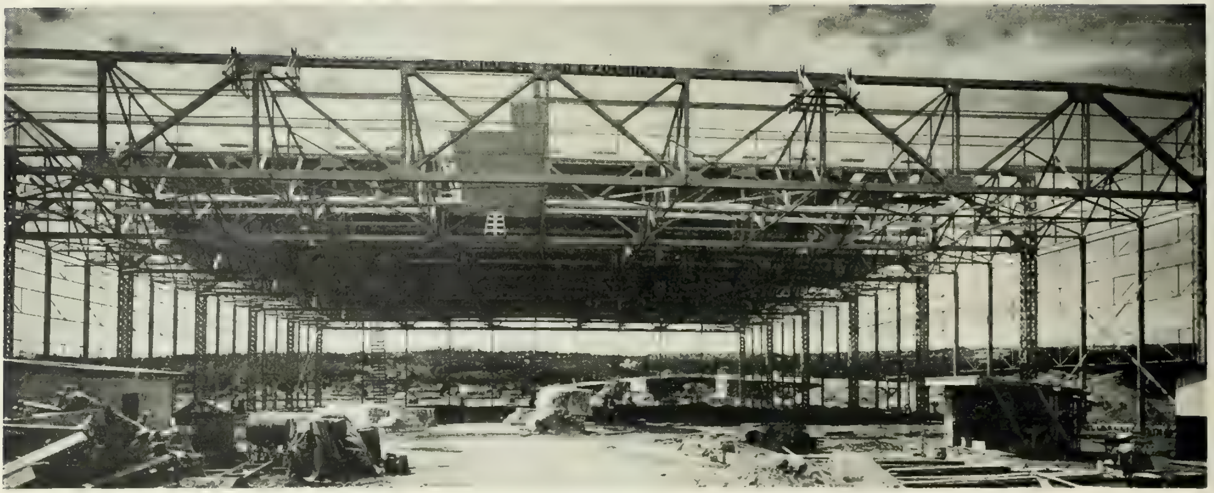

Boeing's assembly plant, designed and built by the Austin Co., and now nearing completion, will have sufficient floor space to accommodate nine four-engined bombers at one time

(*Continued from preceding page*)

Building Activity

Timm Aircraft Co., started construction, at Grand Central Air Terminal, Glendale, on a drafting room to accommodate their enlarged engineering staff. This room is being built on the side of the hangar Timm now occupies. A lean-to on the side of the hangar is being remodeled to house painting and doping activities, and the stock room is being enlarged.

* * *

Erection of the steel for the Boeing assembly plant is nearing completion, according to The Austin Co., which is building the structure.

The structure will have a ground area 204′ × 304′, and a clear height over this area of 35′, to accommodate nine 299 Bombers, fully assembled, simultaneously. Steel doors operating on an outrigger tract system are being installed to provide an opening 35′ high and 195′ wide.

* * *

U. S. Hammered Piston Ring Co., acquired at Stirling, N. J., a large plant of approximately 40,000 ft.^{2} on an 8-acre tract which will give them adequate facilities and ample provision for expansion.

* * *

Champion Spark Plug Co., started construction on a two-story addition to their engineering building to provide an additional 13,200 ft.^{2} of floor space for research activities.

* * *

Work is rapidly progressing on new additions to the Scintilla Magneto Co. factory at Sidney, N. Y., which will be completed shortly. Additions will practically double present capacity.

$6,000,821 Exports

Through May of this year aeronautical exports from this country were under the value of those during 1935, the total being $6,000,821 compared with $7,029,-713.

During this period most business was consummated in China, $1,258,720 worth of American aeronautical products being imported. Next best dealings were with Argentina, $522,982; Netherlands, $437,501, and Australia, $339,323.

May exports alone totaled $1,599,849, sales including 35 aircraft and 51 engines. April exports brought $859,351, of which $368,134 was for 32 aircraft and $135,210 for 38 engines.

For the five months, exports of 149 aircraft brought $2,540,975; of 265 engines, $1,258,395; and of parts, $1,840,203.

Cub Production

A total of 72 *New Cubs* were manufactured and delivered during July, according to officials of Taylor Aircraft Co. Production was accomplished in 27 working days.

An assembling plant and the start of a branch factory of the company was recently begun by Aircraft Associates at Long Beach, Calif.

(*Continued on following page*)

Digest of Recent Events

Russians Fly 5858 Miles in Non-Stop Flight

A non-stop flight of 5858 miles from Moscow to a point near Nikolaievsk, Siberia was completed by Pilots Chekalov and Baidukov and Navigator Beliakov in an ANT-25 low-wing all-metal monoplane. The flight, which took the men over the Arctic Circle, consumed 56 hours 20 minutes. The original destination was Chita or Irkutsk, Siberia, but adverse weather and the fact that the purposes of the flight had been accomplished brought about a landing short of the anticipated goal. The Russian pilots are thought to have set a non-stop flight record, the previous mark, 5657 miles, being held by Rossi and Codos who flew from Floyd Bennett Field to Syria. JULY 23

Gipson Sets Speed Record For Women

Negotiating a 100-kilometer course from Newark, N. J. to Long Branch, N. Y. and return in 30 minutes 15 seconds, Annette Gipson set a new women's speed record of 125.2 mph in her Lambert-powered Monocoupe. The record is in the second category for light planes and supercedes the old mark of 109 mph made by Louise Thaden a few weeks previously. JULY 30

Altitude Mark Raised To 55,082 Feet

Lieutenant Georges Detere of the French army claimed a world altitude record for Class C aircraft after an official reading of his baragraph showed he reached an altitude of 14,488 meters (approximately 55,082 ft.). The old record was held by Commander Renato Donati of Italy who, on April 11, 1934 attained 47,352 ft. in a Bristol-powered Caproni. Detere made his flight over the Villacoublay airfield. AUGUST 7

Soviet Flyers Flying To Moscow From Los Angeles

Using a float-equipped Wright Cyclone-powered Vultee, Pilots Sigmund Levanevsky and Victor Levchenko are flying from Los Angeles to Moscow by easy stages, to investigate the possibilities of a regular airline over the 10,000-mile route between the two cities. Their course lies northward along the west coast of North America to Alaska, across the Bering Sea to Siberia and from there to the Soviet capital. Floats will be replaced with a land gear in Siberia. AUGUST 5

Women's Seaplane Records Established by Tanner

Piloting her Aeronca-powered Aeronca seaplane over a 100-kilometer course in 55 minutes 55 seconds, Miss Margo Tanner set two women's seaplane records at Langley Field, Va. Miss Tanner's average speed of 66.68 mph was officially tabulated for new marks in the second catagory and also in the unlimited class.

AUGUST 8

Hindenburg Cuts Eastbound Time

The German dirigible LZ-129 *Hindenburg* established a new speed record for the eastward transatlantic crossing when she flew from Lakehurst, N. J., to Frankfort-am-Main in 42 hours 53 minutes, compared with the former best time of 45 hours 43 minutes set July 6. The craft was under the command of Capt. Ernst Lehmann and carried 56 passengers and 2000 lbs. of mail and express. The westbound trip was negotiated over a new course, the dirigible following the longer southerly North Atlantic route over the Azores instead of the Great Circle course. AUGUST 11

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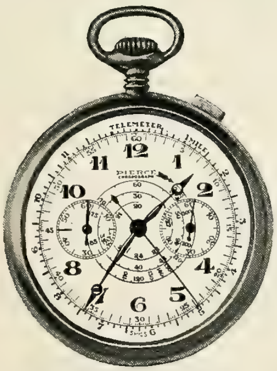
PIERCE CHRONOGRAPH

TELEMETER



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TACHOMETER

For $17.50 you get this combination of Tachometer, Stop-Watch and Telemeter which gives the truth about Time, Speeds, Distances, etc. A Chronograph providing an unlimited number of practical uses in every field.

"Order From The Old Reliable"

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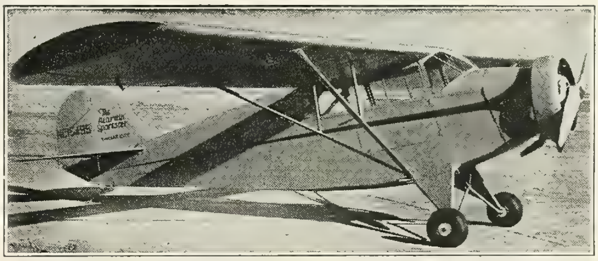
BROOKLYN, N. Y.
DALLAS, TEXAS

NICHOLAS-BEAZLEY

The REARWIN "Sportster"
Unexcelled for Student Instruction



"Sportster" Models 7000, 8500 & 9000 (Available with Edo Pontoons)

Everywhere the "Sportster's" graceful lines, bright colors, and sturdy construction attract students. Its five cylinder, dual ignition, dependable LeBlond or Warner engine inspires their confidence. And its exceptional performance wins their admiration. Fuel tanks in wings insure safety, better balance. No hazardous blind spots—complete visibility in every direction. The rugged 70-inch hydraulic landing gear will "take it" on any field. Gross weight of 1460 pounds gives unusual stability on windy days.

The Rearwin "Sportster" cruises 475 miles at 100 miles an hour, getting 20 miles to the gallon, using little oil. Around airports, the "Sportster" needs only 4 gallons fuel an hour. The cabin is roomy enough for the largest student, is well ventilated in summer, cozily warm in winter. Conversation always easy.

Best materials, careful workmanship guarantee long life, low hourly depreciation. And the "Sportster" excels with the *fastest* take-off, *quickest* climb, *highest* ceiling, and *slowest* landing of all airplanes anywhere near its price. No wonder the Rearwin "Sportster" is the choice of so many leading flying schools and discriminating private owners everywhere.

("Sportsters" now approved for 50 pounds luggage, *plus 50 additional pounds for extra equipment* such as radios, etc.)

(Deluxe ball bearing controls concealed under floorboards available at slight additional cost.)

CONVENIENT PAYMENT PLAN

REARWIN AIRPLANES
Ninth Successful Year

FAIRFAX AIRPORT KANSAS CITY, KANS., U. S. A.

"Rearwin Popularity is proof of Rearwin Superiority."

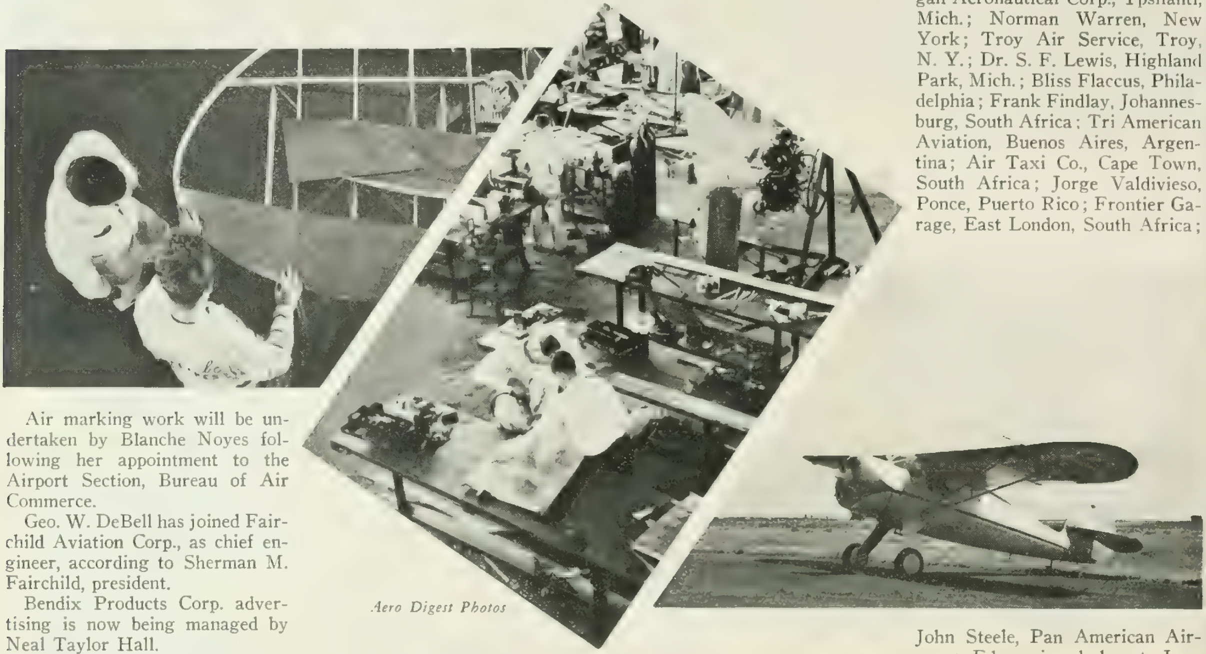
(Continued from preceding page)

Personnel Changes

Glenn D. Angle, technical editor of Aero Digest, has joined Grow, Joy & Co., Detroit, to offer consulting service in aeronautical and internal combustion engineering.

Los Angeles factory representation for Ryan S-T planes is now under the direction of Sam Breder.

Geo. M. Smith, formerly with Pennsylvania Air Lines, joined the sales department of H. C. Robbins Co., at Cleveland.


Aero Digest Photos

Activity at the Luscombe aircraft factory in West Trenton, N. J.

Air marking work will be undertaken by Blanche Noyes following her appointment to the Airport Section, Bureau of Air Commerce.

Geo. W. DeBell has joined Fairchild Aviation Corp., as chief engineer, according to Sherman M. Fairchild, president.

Bendix Products Corp. advertising is now being managed by Neal Taylor Hall.

Raycroft Walsh, vice-president of United Aircraft Corp., and general manager of Hamilton Standard Propellers Division, has been elected to the Board of Directors of United Aircraft Corp.

Business Reports

United Aircraft Corp. has taken over the business of its former subsidiary, United Aircraft Manufacturing Corp., and operations of the various divisions of that corporation are now being conducted by corresponding divisions of United Aircraft Corporation as follows: Pratt & Whitney Aircraft; Hamilton Standard Propellers; Chance Vought Aircraft; Sikorsky Aircraft; and United Airports.

* * *

Lockheed Aircraft Corp. announced early in August receipt of orders for 7 new twin-engine transports, involving approximately $320,000. New contracts, which include one from the Army Air Corps for three standard *Electra* transports, increased total unfilled orders to more than $700,000, for eight $50,000 *Electras,* five $40,000 Lockheed "12's" and a contract involving $12,000.

Central Airlines, Inc., operators between Washington and Detroit, via Pittsburgh and Cleveland, reports profit from operations of $9,866.71 for the first seven months of 1936 as compared with a loss of $78,035.60 for the same period in 1935.

* * *

Boeing Airplane Co. and subsidiaries report consolidated net profits of $113,982.44, after normal income tax, for the second quarter of 1936. Earnings equal 25.6 cents per share on capital stock and scrip certificates outstanding June 30. Sales and other income were $649,528.38 for the second quarter, and $1,453,168.15 for the half year. Cost of sales, operating expenses, and other deductions totaled $515,635.94 for the quarter and $1,360,744.92 for the half. Figures include allowances for depreciation of $21,630.73 during the quarter and $43,519.67 during the six months.

* * *

Kinner Airplane & Motor Corp., Ltd., filed registration statements with S. E. C. covering 500,640 shares of common stock. Stockholders will be given the right to purchase new stock in the ratio of one new share for each 2½ shares held at 50 cents a share.

* * *

Second quarter net profit of the Curtiss-Wright Corp. amounted to $553,341 after charges and taxes, compared with $268,479 in the preceding quarter and a net loss of $97,472 in the second quarter of 1935. Half year profit came to $821,820, against a net loss of $331,608 a year ago.

Sales

Douglas DC-2 to Central Bank of China, Shanghai.

Five DC-3 transports to be powered by two P & W twin row engines to United Air Lines.

Fairchild "24" to Garrison Norton by Gillies Aviation Corp., Hicksville, N. Y.

Waco deluxe Cabin with 320 hp Wright Whirlwind to Leland Hayward, New York, N. Y., by Waco Sales of New York, Roosevelt Field, N. Y.

Two Lockheed *Electras,* P & W-powered, to Canadian Airways.

One thousand and fifty Continental A 40-3 engines to Taylor Aircraft Co.

Warner-powered Fleet to Victor Emanuel by Reich Air Services, Roosevelt Field, N. Y.

Fairchild "24" to Gillies Aviation Corp., by Depew & Havens, Roosevelt Field distributors.

Lycoming-powered Stinson to Dr. A. L. Cooper, Scottsbluff, and Stanley Faulkner, Mitchell, Neb.

Sixteen Rearwin Sportsters during June and July for domestic use and five of the same type for export, as follows: Interstate Aircraft Sales, Minneapolis (3); Licon Air Service, Islip, N. Y.; Law & Harris, Lambert-St. Louis Field, St. Louis (2); Tarkington Aviation Co., Indianapolis; Michigan Aeronautical Corp., Ypsilanti, Mich.; Norman Warren, New York; Troy Air Service, Troy, N. Y.; Dr. S. F. Lewis, Highland Park, Mich.; Bliss Flaccus, Philadelphia; Frank Findlay, Johannesburg, South Africa; Tri American Aviation, Buenos Aires, Argentina; Air Taxi Co., Cape Town, South Africa; Jorge Valdivieso, Ponce, Puerto Rico; Frontier Garage, East London, South Africa; John Steele, Pan American Airways; Edo equipped plane to Juan Trippe, Pan American Airways.

Dealers

Antonio L. Seabra, Rio de Janeiro, Brazil, for Ryan S-T.

Johnston Air Service, San Francisco Bay Airdrome, for Porterfield aircraft.

Airplane Parts & Supplies, Inc., Glendale, Calif., for California propellers.

Coming Events

1936 National Air Races, Los Angeles, Calif. Sept. 4-7

●

Air Races, Martin Airport, Olean, N. Y. Competitive events and exhibitions. Sept. 12-13

●

Deutsche de la Meurthe Cup Race, auspices Aero Club of France, Etampes Montdesir Airport. Sept. 13

●

Air Service Veterans re-union and banquet, Hotel Carter, Cleveland, Ohio, during American Legion Convention. Sept. 21-24

●

National Aircraft Production Meeting, SAE, Ambassador Hotel, Los Angeles, Calif. Oct. 15-17.

●

Eighteenth annual convention, American Society for Metals, Cleveland, Ohio. Oct. 19-23

Third annual convention Air Line Pilots Association, Shoreland Hotel, Chicago, Ill. Oct. 19

●

Paris-Saigon round-trip speed race, sponsored by Aero Club of France. October 25

●

International Aviation Show, Grand Palais, Paris, France. November 13-29

●

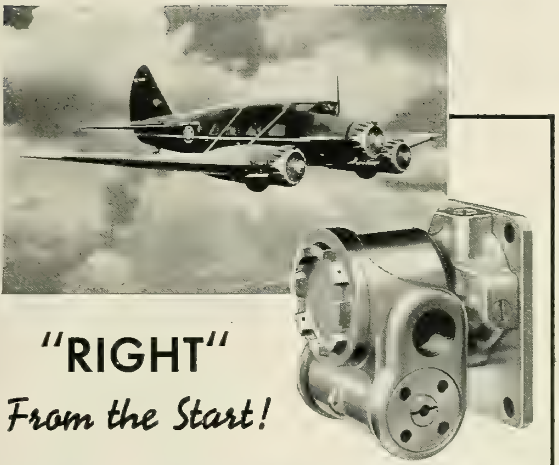
Aircraft Show, Miami Municipal Airport, Miami, Fla. Dec. 6-12

●

Ninth Annual Miami All-American Air Maneuvers, Municipal Airport, Dec 9 12

●

National Aircraft Show, auspices Aviator's Post 743, American Legion, Grand Central Palace, New York, N. Y. Jan. 28-Feb. 6, 1937



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Riding through the skies with RCA

The sleek Richfield Eagle, a Northrop Executive Plane, is equipped with RCA's AVR-7 receiver!

THE fast, handsome sky speeder pictured here is used by an executive of the Richfield Oil Company. And, as part of this plane's equipment, an RCA AVR-7 receiver was installed.

This is but one of many airplanes that ride through the skies with RCA's great aviation apparatus. The RCA trademark has become symbolic of sure, safe flying, and the varied aviation equipment now in use which bears the RCA name, is *proof* of its efficiency and economy.

No matter what the needs of aircraft or airport—if it's in connection with radio—RCA makes it—and makes it well! RCA's aviation radio apparatus includes the new radio compass for planes, airport beacons, airport and aircraft receivers and transmitters. Free literature, giving facts concerning all aviation equipment bearing the RCA name, is yours on request.

RCA Aviation Radio Instruments are sold by AIR ASSOCIATES, INC., Glendale, Calif.; Chicago, Ill.; Garden City, L. I.; or write direct to Aviation Radio Section, RCA Manufacturing Co., Inc., Camden, New Jersey. *A service of the Radio Corporation of America*

RCA *for Aviation Radio*

FOREIGN NEWS IN BRIEF

Australasia

The Perth to Adelaide run of West Australian Airways has been taken over by Adelaide Airways Ltd., which eventually may be merged with the recently organized Australian National Airways. The Perth-Adelaide service may be extended to Sydney so that passengers leaving Perth may reach Sydney at noon of the day following departure.

Enlargement and improvement of the Dekhela Airport, Alexandria, Egypt, is planned to be started shortly and completed by June, 1937, at a cost of about $2,500,000. Buildings for the airport management, navigation control office, customs, quarantine and passport control offices, meteorological station, etc., will be provided. Present lighting facilities will be expanded and two large fuel tanks added. A hotel for passengers will be built and there will also be accommodations for seaplanes.

South African Airways is planning additional services between Johannesburg and Lourenco Marques and between Johannesburg, Port Elizabeth, and East London. Johannesburg-Lourenco Marques route will probably be via Kamatipoort during the season that the Game Reserve and Kruger National Park is open, and through White River during the remainder of the year.

Statistics show that in 1935 licensed Australian planes flew 5½ million miles, carried 62,910 passengers, 8463 tons of freight, and 70 tons of mail. Number of private pilots increased from 467 to 680; commercial pilots from 210 to 212, registered owners from 113 to 130, and registered aircraft from 200 to 227. All air services carried 17,288 passengers.

A $5,000,000 syndicate has been formed to manufacture Australian planes, as a defense measure. Companies associated are: The Broken Hill Pty. Ltd., Broken Hill Assoc. Smelters Ltd., and General Motors-Holdens Ltd. The Government has had difficulty in obtaining aircraft from England, and the syndicate will manufacture British types of military aircraft.

England-Durban service by Imperial Airways will be inaugurated early in 1937 with a six-day schedule. Stops will be at Dar-es-salaam, Quelimane, Beira and Delagoa Bay, and from there to the terminus. In the past, many prospective air passengers wishing to travel between different points in the Union and Rhodesia were unable to obtain accommodation in Imperial Airways planes, which were filled with through passengers. The new arrangement will overcome this obstacle since all through passengers and mail will be conveyed in Imperial Airways' flying boats. Other passengers will have no difficulty in booking on South African Airways' internal service to Rhodesia, or on services of the Rhodesia and Nyasaland Airways which will cooperate with South African Airways in operating over the Germiston-Lusaka route.

Serving Newcastle, Cessnock, Tamworth, Tenterfield, and Warwick, a new route to Brisbane will shortly be opened by Airlines of Australia. The service, which will be weekly at first, is an addition to the existing service to Brisbane.

Canada

Daily (except Sunday) service is now operating between Montreal and Ottawa as an extension of the Montreal-New York service. Canadian Colonial Airways is flying mail over the new section of service under a contract with the Canadian Post Office Department. Through connections at New York, communication between Ottawa and cities in western Canada as well as throughout the United States and other countries in the Americas are speeded considerably.

In line with reorganization of Canada's national defence, promotions have been made in the non-permanent flying squadrons of the Royal Canadian Air Force. Early last month A. H. Keith Russell, former president of the Canadian Flying Clubs Association, was promoted to Flight Lieutenant of No. 10 squadron. R. Foley and N. D. MacGregor of Hamilton were likewise promoted from Flying Officer to Flight Lieutenants of the 19th bombardment squadron

A course in aeronautics, the first of its kind offered in a Canadian university will be inaugurated at the University of Toronto next fall, according to W. J. Dunlop, head of the Department of Extension.

Instruction will be given in the types of aircraft and their component parts; principles of flight, aerodynamics; model testing; conditions of longitudinal and lateral stability; structural design; lighter-than-air craft; and the practical use of wind tunnel instruments.

Qualification for admission will include honor matriculation with a 75% standing in all mathematical subjects. Those qualifying will take the first two years in engineering physics.

An airport under construction at Gander Lake is being built by the British Air Ministry for use in transatlantic flights. Runway area will total 242 acres. The main runway, lying NE-SW, will be 4800 ft. long and 1200 ft. wide. Three others will be approximately 4500 by 600 ft., lying at 45° to the main runway. Buildings surrounding the field will include quarters for a permanent staff, machine shops, hangars, a hotel and stores. The site was selected last year by representatives of the British and Canadian Meteorological Bureaus.

Daily mail service between Haileybury, Ontario, and Mud Lake, Quebec, has been inaugurated by the Dominion Skyways Ltd., which operates under a contract with the Post Office Department. This service connects the two mining centers, 65 miles apart, and will be continued through the winter if traffic warrants.

Passengers and mails will be carried across the North Atlantic Ocean at least twice a week in each direction when regular service, to be worked in conjunction by British and American companies, is established. Announcement that the governments concerned in operating the British service (Great Britain, Canada, Irish Free State and Newfoundland) had approved plans drawn up in discussions at Ottawa last November has been made by Sir Philip Sassoon, Under-Secretary of State for Air, who indicated that two stages would precede the regular service; the first to cover a series of survey flights, and the second an experimental service transporting mails only. Preference will be given to the direct route extending from England to Canada via the Irish Free State and Newfoundland. For an initial period, however, it may be necessary to operate the service by way of Bermuda during winter months.

A joint operating company will be incorporated at the instance of three companies, of which one will be nominated by each of the governments of Great Britain, the Irish Free State and Canada. Great Britain chose Imperial Airways, which temporarily will conduct experimental flights. Capital will be subscribed and held, 51% by Imperial Airways, 24.5% by the Canadian company and 24.5% by the Irish Free State company. Great Britain will pay for the largest portion of the annual subsidy, Canada contributing 20% up to $357,000, the Irish Free State 5% up to $60,000, and Newfoundland a sum to be agreed with the British government. The remainder will be made up by Great Britain.

Each of the four governments will provide the needed airport,

(*Continued on following page*)

The four-engined Short Bros. flying boat "Canopus" during recent tests before its delivery to Imperial Airways

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MANUFACTURERS
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THE MAKERS OF KENDALL OIL congratulate the Porterfield Aircraft Corp. on the production of its thousandth plane, and wish success to the new Porterfield Zephyr. Available in refinery-sealed containers at most airports, Kendall Oil has long been the popular favorite of aviators. It is refined 100% from Bradford Pennsylvania Crude.

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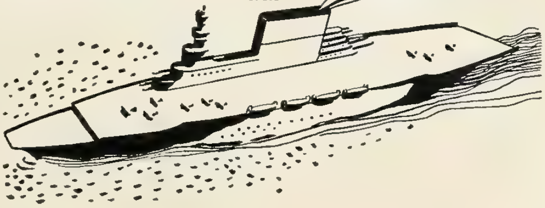


The ANT-25 in which a 5858-mile non-stop flight from Moscow to the far north was accomplished

(Continued from preceding page) radio and weather forecasting facilities.

In return for landing facilities to be granted the joint company by the United States, Pan American Airways, which is to share in the service, will be granted landing facilities in Great Britain, Canada, the Irish Free State and Newfoundland. Each of the four governments has also undertaken to grant landing and transit rights within its own territory to the joint company and to Pan American Airways.

Elimination of competition between two large British air transport companies on the Scandinavia run and strengthening of claims to be awarded government contracts for flying mail over the South Atlantic Ocean are secured by an amalgamation between British Airways and British Continental Airways.

British Airways was formed last year to acquire the assets of Hillman's Airways, Spartan Airlines and United Airways. It also owns a majority interest in Highland Airways, and Northern & Scottish Airways. British Continental Airways is backed by London insurance interests.

Figures reflecting the growth of civil aviation are reported from Heston airport, the terminus of important airlines as well as the site of considerable taxi and private flying activity. In the first six months of this year general traffic showed an increase of 24% over the corresponding period of 1935.

Take-offs and landings (not including students) registered between 8 am and 8 pm daily, numbered 19,900. Customs traffic showed 7,072 passengers clearing customs at the airport compared with 2,956 in the first half of 1935. Jersey Airways carried 3,317 passengers on the London route, a 4% increase. Departures or arrivals of chartered planes and of craft engaged on non-regular services numbered 1,422, or 9% more than in 1935.

Canopus, first of the fleet of four-engined monoplane flying-boats which the Short company is building for the Empire air routes, successfully passed its preliminary handling and flight trials. It is now being equipped with soundproofing, furniture and travelling equipment.

Piloted by J. Lankester Parker, chief Short test pilot, the ship showed a normal cruising speed of about 150 mph. At that speed it will transport 24 passengers (16 with sleeper accommodations) their luggage, and almost 3.5 tons of mail and express for 800 miles non-stop. By adjustment of payload, range can be increased to 1,500 miles.

Colonel Sir Donald Banks, Director-General of the Postoffice, was appointed Permanent Secretary to the Air Minister, succeeding Sir Christopher Bullock. Last year Sir Donald was appointed member of the council of action for the development of civil aviation in the United Kingdom, whose task was to take account of the requirements of the postoffice in regard to air mail. He was a member of the delegation that conferred with the Canadian Government in Ottawa in November on a transatlantic service.

Japan

Successful experimental aerial surveys conducted by the Japanese Railway Dept. for a number of years has resulted in the purchase of two planes for this purpose. Orders were placed with The Mitsubishi and Nakajima Aircraft Works.

The Mitsubishi is a wood and metal monoplane equipped with three seats, glass covered windows and ceiling, and apparatus for aerial survey purposes. Power is supplied by a 400 hp Mitsubishi air-cooled engine.

Japanese military air force has been reorganized and enlarged into a virtually independent arm of service under a new headquarters, which will have almost the same status as the War Office and the General Staff. A War Office communiqué announcing the change states the situation requires that army aviation be extensively developed. There will be created a virtually independent fighting organization, and the expanded air force will lead the army in land operations. The Chief of Aviation will be accorded a status similar to that of Inspector General of Military Education—virtually equal to the War Minister and the Chief of the General Staff. He will be appointed by the Emperor from officers of the rank of lieutenant general. The air force will, according to present plans, consist of three brigades; the first is that organized last year at Gifu, the second to be based on Kwainei, Korea, near Vladivostok, and the third on Formosa.

Latin America

Commercial airlines of Chile, Bolivia and Peru will link their services, it was announced after a meeting, at Arica, Chile, of the president of Chilean Airlines, Commander Merino Benitez; president of Bolivian Lloyd Aereo, Luis Prieto, and a director of the Peruvian Fawcett Lines. A general reorganization is considered. This was the first time technical executives of commercial aviation had come together in South America with the object of extending contacts to speed up traffic between neighboring countries.

Isthmian Airways suspended service after seven years of operation involving 6000 flights over the Panama Canal between the Atlantic and Pacific. More than 65,000 passengers, most of them tourists, were carried. Suspension was caused by expiration of operation permit for equipment being flown.

Twice weekly service to Brazil via the West Indies and east coast operated by Sikorsky S-42 flying boats and another day clipped off the time to Buenos Aires has been announced by Pan American Airways. In addition one day service to South America from Miami to Barranquilla with similar reductions in transit time to other points is offered. Coupled with this improvement in schedules and equipment was the announcement of the elimination of extras for meals aloft and taxi fares to and from airports which will now be included in fares in Latin America except at Havana and Nassau and at terminals in this country.

Russia

Flying an ANT-25, three Russian pilots made a survey of the far north in an endeavor to ascertain the feasibility of a new route from Moscow to the west. In charge of V. P. Chekabov who was assisted by G. F. Baidukov and A. V. Beliakov, the flight proceeded from Moscow to Barentz Sea, Franz Joseph Land, Cape Cheliuskin, Petropavlovsk-on-Kamchatka and then in the direction of Nikolaevsk-on-the-Amur-Chita. After 56 hours 20 minutes of flight the plane covered 5858 miles and landed at Udd, west of Nikolaevsk.

The ANT-25 is a single-engined monoplane powered by a 950 hp, Vee type, M-34 R engine.

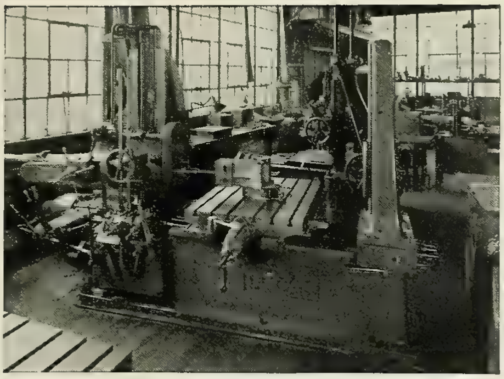
Spain

A new Lisbon company, known as Companhia Portuguesa de Aviacao Aero Commercial, has informed National Air Council that it proposes to inaugurate weekly passenger and express service between Lisbon and Oporto. The company also intends to have planes available for tourist flights around Portugal and for charter work as well as a school of civil aviation.

Sweden

Four Junkers Ju 52, transports have been ordered by Swedish Air Transportation Co. for early delivery. This equipment which will cost approximately $258,000 will be used in the night mail as well as passenger service. The company is expected to expand its activities considerably when the new planes are ready for service.

Direct mail services between London and Stockholm opened last month when British Airways, which has the contract for carrying mail without surcharge as far as the Swedish capital, extended service from Malmö to the new Stockholm airport at Bromma.



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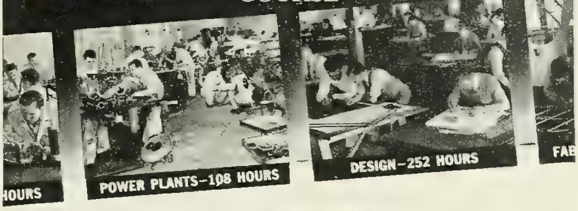

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GLAZING OF AIRCRAFT

(*Continued from page 23*)

Soundproofing

According to the Bureau of Standards the soundproofing value of a material depends directly upon its mass or weight, as used. Direct tests demonstrate that the soundproofing value of glass panels varies directly with the thickness of the glass, as does its weight/ft.^{2} These values vary somewhat from the mean values when separate sound wave bands are considered, but the mean or average reduction factor in sound units or decibels, when such factors are plotted against the logarithm of the weight of the glass in question, are found to lie upon a straight line. This line of average values for homogeneous glass may, therefore, be taken as a base line of reference for the laminated glass products.

Considered on this basis, and comparing the laminated glasses, weight for weight, with the homogeneous glass, the former made up using the stiffer less flexible plastic (in the low frequency range) exceed the values for homogeneous glass, while the laminations made up with the softer more pliable plastics fall below.

In the range of low frequency sounds (150 to 180 cycles), such as largely produced by the noise of an engine, the weight of the laminated glass, made up with the softer plastics, must be increased as much as 80% beyond the weight of homogeneous glass which will produce the same reduction. On the other hand, the weight of the stiffer, harder plastic lamination may be nearly 50% less than that of the homogeneous glass required to produce the same reduction in sound effect.

In the sound wave band of 400 to 440 cycles (always referring to comparable weights of the laminated products and the homogeneous glass) the laminated glasses still remain less satisfactory than equivalent thicknesses of homogeneous glass. In this region, the laminated glasses begin to approach more closely to the homogeneous glass and in one instance the harder plastic lamination has a reduction factor somewhat higher than the homogeneous glass. To have the same reduction factor, the laminated glass would have to weigh 25% more than the homogeneous glass, and there is little, if any, difference between the laminated products.

In the frequency range from 1000 to 1093 cycles, the reduction factors for the several types of laminated glass, considered on the basis of weight for weight, or thickness for thickness, lie close together and there is little to choose between them. In this range, the laminated glass must be approximately 40% heavier, as an average, than the homogeneous glass, to produce the same sound reduction factor.

Considering the over-all average values for the several products under discussion, the laminated glasses still fall below the values for homogeneous glass, the several different types falling so nearly exactly on the same straight line that deviation from that line is well within experimental error limits.

When the entire laminated glass soundproofing problem is ultimately summed up, there is no choice as between one type of lamination and another and little choice as between laminated glass and homogeneous glass for soundproofing purposes. The sound insulation values of glass products depend absolutely upon the weights of those products and to relatively small degree upon their composition.

Bureau of Standards Research Paper No. 63 (from which the previous data has also been drawn) shows ⅛" and ¼" thick glass having reduction factors of 27.9 and 31.6 sensation units respectively. Two ⅛" thick glasses spaced ½" apart, show a reduction factor of 33.1 sensation units, and on this basis, double glazed ¼" thick glass should show a reduction factor of at least 38 sensation units. The sound insulation value increases as the logarithm of the weight of the soundproofing material, and the spacing between the glasses will add, at least in some degree, to the soundproofing value.

Insulation

From the point of view of heat transmission, laminated glass is essentially equivalent to the same thickness of homogeneous glass, although there may be a slight advantage in reduced transmission with the laminated product.

Double glazing with an hermetically sealed air space between the two glasses is essential for satisfactory cabin insulation. For maximum efficiency, the space between the glasses should not exceed 1" up to 1¼" and should not be less than ¾". Either side of these outside limits, the efficiency of the double glazing as an insulating medium falls off rapidly. Space also must be as nearly chemically dry as possible, and must be maintained so as near as practicable. Otherwise, the formation of frost upon the surfaces of the glass (especially where spaces of more than ¼" are used) between the glasses, will seriously hinder effective vision. This problem is receiving considerable attention at this time and a solution is expected in the near future. As yet, no wholly satisfactory double glazed unit has been constructed in which there will not be some fogging after temperatures of —20° to —40° are reached.

The problem of multiple glazing is further complicated by the fact that ordinary glass tends to break down in such hermetically sealed spaces and to become objectionably obscured due to the formation of crystals upon the enclosed surfaces. This deterioration will occur within a period varying from a few weeks to several months, and under the conditions of operation which an airplane must meet, will presumably appear within the shorter period of time.

Crystalex plate glass has been devised for making up double glazed and other multiple glazed units which may be fabricated. Regular glass surface contains water, present as a solution of various glass component salts. In hermetically sealed spaces, changes of temperature or barometric pressure tend to evaporate this absorbed moisture, or to recondense such moisture upon the glass surfaces. When the moisture evaporates, the glass component is laid down as a non-hygroscopic crystal which does not readily re-dissolve in the condensing of moisture. As a result, the absorbed moisture is not saturated with glass salt and further solution can take place with the continued crystalization of glass component upon the glass surfaces. In *Crystalex* plate glass, the appearance of heavy bloom or crystals never becomes visible to the unaided eye in ordinary light, although traces of bloom may be found when the glass is exposed to a high powered light.

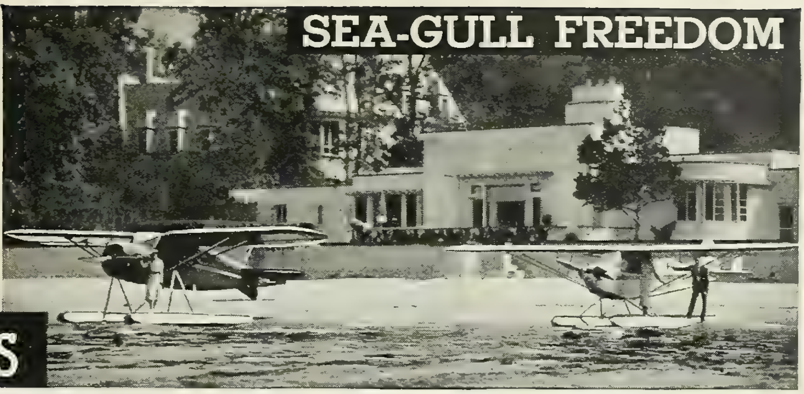
In clarity and transmission values, *Crystalex* is the most highly transparent plate glass presently available. Having a transparency of approximately 91 to 91.5 throughout the visible spectrum, it transmits as much of the violet and red portions as it does the green and yellow. Ordinary glass transmits, approximately 88% to 90% of the green and yellow and rapidly drops off to the neighborhood of 75% in the red and 80% in the violet ends of the spectrum. Transmission of *Crystalex* continues far out into the ultraviolet region, showing approximately 16% of ultra-violet wave lengths 303 mm., where ordinary plate glass will transmit between 3% and 5%.

As a conductor, glass approaches steel; ½" thick glass will transmit and conduct almost as much heat as ¼" thick glass. Multiple glazing depends entirely on the space between the glasses for its insulating value, and this spacing is of prime importance in gaining insulating value.

The insulating value of multiple glazing seems to depend largely upon the static surface films of air on the glass surfaces, both exterior to the air space and that contained within the air space. The insulating value of the air space steadily increases as the air space is increased up to ¾", remains virtually stationary from ¾" up to 1¼", and then again begins to fall off. Consequently, maximum insulating value is gained at a spacing any place between ¾" to 1¼".

Pilot cockpits may also be insulated against frost formation on the interior by multiple glazing. In this case, as well as in the interior of the cabin, multiple glazed

(*Continued on following page*)



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(*Continued from preceding page*)

units may be materially reduced in weight by glazing the pressure resisting glass to the outside of the hull and in turn glazing into the assembly a thickness of glass which is just adequate to sustain the differential in pressure between sea level and the supercharge pressure within the cabin.

With present equipment, it will not be possible to satisfactorily bend glasses to double curvature in the thicknesses which will be required to sustain the loads anticipated at high elevations. However, since at the extremely high altitudes contemplated, the surrounding atmosphere is essentially dry there is no reason why thin glass could not be glazed in the hull, with a space between that thin glass and the glass which is actually to carry the load of the pressure. This outermost or shell glass, may be laminated so that there will be a flange and the outermost surface can be made flush with the hull of the ship. It may also be possible to grind a rabbet in the glass for similar purposes, and then use a single thickness of glass not laminated. However, in order to follow out this last plan satisfactorily, the glass would have to be approximately ⅜" thick, as would also be the case with the laminated product. The space between the shell glass and the surrounding atmosphere should be vented to the surrounding atmosphere so that the pressure on either side of the thin glass shall always be equalized, at whatever level the plane may fly. This procedure would be entirely practicable and satisfactory for windows intended for passenger use, but would presumably be unsatisfactory for the pilot.

Certain distortional effects would result from the bent glass surfaces, unless the innermost glasses were bent to the same curvature. However, if such thin shell glasses are used, there will be little difficulty about the curvature of the glass to meet the radius of curvature of the hull's dimension, either spherical or cylindrical, and the edges of the window can be beveled or rabbeted as above indicated.

It will always be possible to use sufficiently heavy glass and grind the surfaces so that distortional difficulties will be avoided when two glasses of the same curvature are double glazed together, and double glazed so that the faces remain parallel.

It appears impossible to produce a "flange" bend around the periphery of a true plate glass or true window glass surface and maintain satisfactory visibility through the glass. The problem does not involve the question of low thermal expansion, but would seem to be entirely one of mechanical possibilities and procedure.

In order that the outermost glass may more nearly conform to the periphery of the surface of the fuselage, this glass might be cut at a bevel and set into a bevel similar to the method of setting a watch crystal. This, however, will materially increase the cost of the glasses because of the expense of grinding the beveled edge and may involve certain other difficulties of setting which are not immediately recognized. It probably will be difficult to produce a bent glass of the slight curvature required to follow the contour of the fuselage.

Pittsburgh Plate Glass Company has been endeavoring to foresee the future trend of aerial navigation and has devoted the past five years to the study of aeronautical problems as they effect glazing. Numerous tests have been conducted to determine the strength of glass under reduced pressures, or increased pressures, both for the purposes of aerial navigation and for the equipment of modern high-speed trains.

CONSTANT SPEED PROP

(*Continued from page 37*)

the case of single-engine planes, since any slight variation throws the engines out of synchronism. With constant speed propellers synchronism is closely maintained, even in two, three, and four engined craft, all also being comparatively free from being thrown out of synchronism by rough air.

The most extraordinary condition to which constant speed propeller action can be subjected is the sudden change in propeller pitch required to accommodate a burst of throttle on one engine with the remaining engines running steadily in flight. Under these conditions the constant speed propeller responds quickly enough to bring engine speed back to synchronism with the other engines in one or two seconds.

Appreciable fuel saving can be derived by long-range craft using the constant speed propeller, since it permits engines to be operated under economical conditions during climb and descent from cruising altitude as well as while cruising at various altitudes selected. In descending from cruising altitude it is possible to increase airspeed without change of engine rpm or power.

Experiments have been conducted recently in combination with automatic mixture controls which maintain pressure below the carburetor constant. It has been demonstrated that fuel consumption is reduced by governing the power by the constant speed control, leaving the throttle wide open.

CATHODE RAY FINDER

(*Continued from page 19*)

statically* shielded annular type arranged for complete and continuous rotation about its vertical axis within a fixed housing of low air resistance. The overall electrical characteristics of the loop antenna were found to be commensurate with the frequency range coverage of the receiver and of such order as to insure permanency under usual service operating conditions. One of the basic requirements of equipment of this type is that electrophysical values be maintained within prescribed tolerances, thus requiring the use of materials which are most adaptable to each specific purpose.

The receiver is designed for installation near the loop assembly and can be installed in various types of aircraft. Total weight of the equipment is approximately 75 lbs., and the necessary power for operation is derived from the regular 12-volt storage battery installed in the airplane for starting and lighting purposes. The equipment is completely encased in an electrostatic shield. The receiver unit governs the requirements of mechanical and electrical interchangeability from one installation to the other without involved operations. When changing a receiver, it is not necessary to realign or recalibrate the electric circuits, insofar as directional accuracy is concerned.

While performance of this equipment has proven encouraging with regard to its utilization for aircraft navigation, its application to marine direction finding will no doubt constitute a further improvement.

---

*Shielded loops have been used successfully by the Coast Guard for the past five years in effectively reducing snow, rain and dust static on aircraft.

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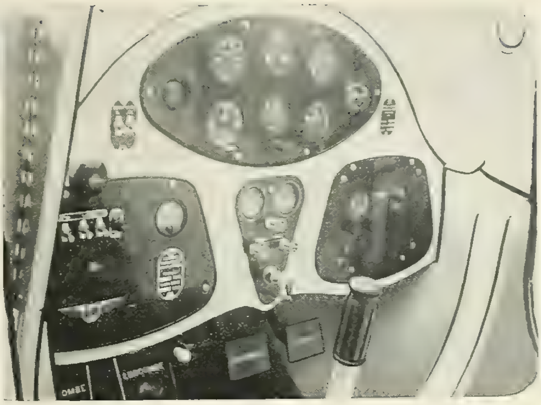

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PERSONAIRLITIES

(*Continued from page* 64)

centuries until it's actually getting monotonous.

Doty resigned from the Army in 1920 and became an instructor for the Philippine Government, and later for the Portuguese and Chinese Governments. He was the head of the Portuguese Air Service at Macoa, So. China, and in 1922 and '23 was connected with the Cantonese Chen-Quing-Ming Government as instructor. That must have been quite a task, not the least difficult part of which would be the matter of identifying his pupils. It's a smart instructor who knows his own pupils in China, because all Chinamen look alike to white men. They vary only in size and weight, but all have practically the same faces. That saying, "It's a wise child that knows his own father" originated in China, along with the pigtail, which was grown so the child could cling to his parent as he walked along the street, and not get lost forever.

The strain of sorting out Chinamen finally proved too much for Doty, so he gave up, got married, and returned to the States, where we all look so different that it's really painful to contemplate. His wife, an American girl, had been teaching school in the Philippines, and I suppose had got tired of sorting out Filipinoes—another unvaried looking breed of human.

When he returned home, Pilot Doty followed the way of all flesh and became a barnstormer, but in 1926 he reformed and became a reserve air mail pilot at Concord near San Francisco. Later he ran a flying school at Oakland, Cal., and in Sept. 1928, he went with Western Air Express as pilot on the Los Angeles-Salt Lake run, and later on the Los Angeles-Oakland run. On Oct. 15, 1930, he became one of the four original pilots on the Western Division of American Airlines. He is now flying the Los Angeles-El Paso run of that company's transcontinental route and has flown to date over 11,000 hours. He was born November 15, 1893, in Utah, and is still going strong.

The accompanying photograph, kindly sent to me with a word of explanation by my friend Harry Maynard of Los Angeles shows Dave, wearing a coat to protect his ancient frame from the cold California air last April, and greeting another old-timer, Alfred J. "Pop" Croft, stoutly enduring the rigors of the California climate without an overcoat. It is very seldom that you see two old pilots holding hands like this—and I harbor the suspicion that they were posed that way by Harry Maynard the old fox as a publicity stunt for American Airlines. As it says in the Bible, the ways of a man with a maid and the way of an eagle in the air and the ways and means of a publicity representative are beyond figuring out—though I believe I've figured this picture correctly.

Be that as it may, Mr. Croft began his flying career in 1914 with the Curtiss Flying School at North Island, San Diego, when it was necessary to become a self-taught pilot: they simply told you approximately how it went up, and up you went. During the war he was a civilian flying instructor at Mineola, L. I., and Brooks Field, Texas. He went to Manila, P. I., in 1919 for the Curtiss Co. and organized the Philippine Air Service. It was there that he met Dave Doty while that gentleman was constructing Clark Field for the Japs.

While Doty was organizing the Portuguese Government Air Service in the islands, Pop Croft held a similar post for Dr. Sun Yat Sen's Cantonese Government—no relation to the Sen who invented Sen-sen for halitosis—this was another Sen. Doty and Croft used to leave their armies and fly over to the neutral ground of Hong Kong and compare notes on which were harder to organize, Portuguese or Chinese. It was a toss-up. However, once you get a Portuguese organized, he stays organized; organize a Chinaman, and he comes unorganized again before you can say chop suey. Furthermore, you can get one Chinamen to agree with you; but you can't find two Chinamen who agree with each other. Also, if anyone cares, the Chinese make fair pilots; but get two Chinamen flying formation and their net flying efficiency drops 75%. I never will understand them. I don't believe they understand each other. Of course they were civilized thousands of years before we white races were—which proves what civilization will do to you if you make a mistake and work at it long enough. That may be why the Germans are frankly reverting to a state of barbarism under Hitler.

Mr. Croft, who was back in the States for a visit, now is superintendent of the Automotive Shops of the Pacific Commercial Co. in Manila. He has an international family. Mrs. Croft was born in Chicago, although her parents are now living in California; the oldest Croft son was born in California, the daughter in Honolulu, and the youngest son was born in China, while Pop himself, a naturalized U. S. citizen was born in Berkshire, England. It takes a man with a background like that to organize Chinamen into an Air Service.

● That modern inventions have not appreciably changed human nature has been remarked before, but Leon M. Siler of the New York Post (Founded 1801) confirms it with this little story of what Pilot A. R. Perkins of American Airlines had to say when he landed at Little Rock:

"It was in the early and balmy light of a lovely southwestern dawn that the Douglas of which he was in command slid down to the Little Rock airport. The passengers Oh-h-ed and Ah-h-ed appreciatively as they climbed out on the dewy grass and surveyed the soft Arkansas landscape." (Carroll Cone wasn't on hand, or the landscape would have looked even softer.—Cy.)

"After them came Pilot Perkins, handsome, smiling, resplendent in his American Airlines uniform, lustrous in his role of skipper of the silver-winged skyliner that had skimmed so swiftly, so surely through the gloom of night, hour upon hour, to this fetching moment. Symbol of the new day was Pilot Perkins as he stood there beside his ship, both bathed in the magic of the dawn's early light; a glamorous figure indeed was he, to groundlings in whom there burned the slightest flicker of imagination and romance. Close around him crowded the passengers, impressed and admiring, ready to hang on his every word.

"And what did this glamorous figure, this resplendent symbol of the new day, have to say? What manner of utterance came from this lustrous conqueror of the night skies? Well, he swept the greensward with a ready glance, did Pilot Perkins, and he swept the passengers with another; and he shot a look at the rising sun, and he said, said he:

" 'Gosh, what a swell morning to go fishing!' "

BOOK REVIEWS

MATERIALS OF AIRCRAFT CONSTRUCTION

By F. T. Hill

The second edition of *Materials of Aircraft Construction* is a revised, enlarged and modernized version of the first edition, providing in concise form data that should be valuable to designers and builders for reference and research.

Materials are individually discussed from the point of view of their production, special properties, and testing. Their different applications are illustrated and the treatments necessary to render them suitable for their individual purposes are described. They range from ferrous and nonferrous metals, rubber and timber, to glues, fabrics, and the materials used for protective coatings, etc.

DIRECT CONTROL AUTOGIRO

A short, interesting presentation, *The Direct Control Autogiro*, sets forth the background, an elemental exposition of the theory, and something of the potentialities embodied in the direct control 'giro.

Published by the Autogiro Company of America, the book is the first authoritative work issued by the publishers on autogiro development of the past three years. Such derivative improvements as direct take-off without forward run, and adaptability to highway use are discussed in a general way.

The section which describes autorotation is particularly outstanding. Simple and clear diagrams not only visualize the phenomena, but also add an enlightening source of information to the explanation.

ELEMENTS OF PRACTICAL AERODYNAMICS

By Bradley Jones

The author, a Professor of Aeronautics at the University of Cincinnati, in the preface to his book states that this work is intended primarily as a text. As such it fulfills its purpose, giving a clear and simple presentation of applied aerodynamics. Its elementary style suggests its use for younger students who desire to acquire a general knowledge of the subject. The greatest part of the text is devoted to aerodynamics including wing theory, propellers, and performance. The chapter on control surfaces could have been enlarged since it appears rather too sketchy even for an elementary treatment. The inclusion of brief references to unconventional types of aircraft, materials, and constructions, instruments, meteorology, avigation and aerostatics must be commended since it rounds out the general familiarization of theory, design and application.

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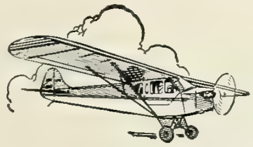

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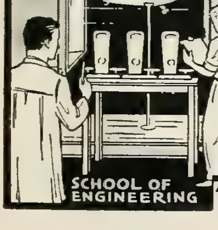

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ATTENTION hedge-hoppers and fence stretchers: I have a C-2; 5 hours since complete overhaul and recover; new propeller and cylinder assemblies. $350. James S. Cox, Flemingsburg, Kentucky.

AERONCA C-2: Licensed till June 1937. Just majored and recovered. Split landing gear; air tires, new cylinder assembly. Price, $400. H. F. Marsh, Adrian, Michigan.

LOW-WING 70: Flap and lights, perfect, $2,000. 1936 C-3, 215 hours, two doors, compass, perfect, $1,350. 1935 C-3, engine just factory majored, ship-excellent, $1,150. J-5 Waco straightwing, Heywood starter, $1,350. English Avian with spare motor, good condition throughout, $550, including spare motor. English Cirrus, new, $250; used, $60. Tred Avon Flying Service, Easton, Maryland.

1935 CABIN AERONCA: In like perfect condition, for $995 cash. Worth $400 more. Closing out all equipment. Offered subject to prior sale. Johnson Wright, P. O. Box 3021, Miami, Florida.

AERONCA C-3: Perfect condition. Extra instruments. Spare propeller, navigation lights. Priced for quick sale, $900. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

C-3 AERONCA: 113-B. 250 hours. Purchased factory April, 1935. Perfect. Compass, air speed, heater, extra gas tank. Used privately. $1,000. S. N. Christensen, Airport, Red Bank, New Jersey.

Aeromarine Klemm

AEROMARINE KLEMM: 70 h.p.; factory rebuilt May 1935. Motor good, overhauling. Fuselage (cloth covered) in prime coat. Wings, center section need minor repairs. Never cracked. No landing gear. Must sell before fall. Earl Stultz, Keyport, N. J.

Amphibions (Privateer)

PRIVATEER AMPHIBION: Warner motor, air starter, metal propeller; only 35 hours since major motor, plane overhaul and relicensing to March 1937. $1,350. Smith Flying Service, Wyoming Valley Airport, Forty-Fort, Pennsylvania.

Aristocrat

ARISTOCRAT: Less motor and prop; otherwise complete in every detail. Licensed until May, 1937. Reconditioned and recovered throughout, $550. G. D. Kelsey, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

American Eagle

OX-5 EAGLE: Licensed to July 1937. Recovered last year. 270 hours. Motor and ship excellent. $395 cash. L. Macomber, 239 Second, Niagara Falls, New York.

FOR SALE: American Eaglet, identified; good covering, motor recently overhauled. Bargain for $375. Clyde Harvey, Greenfield, Indiana.

AMERICAN EAGLE: Long nose OX-5; motor 10 hours since top overhaul; new propeller. Ship needs some work for relicense. Frank Headley, Jr., Lincoln Park, New Jersey.

EAGLET: Just relicensed for 1937; fuselage refinished in high gloss; motor majored; price flyaway, $525. First deposit receives preference. Pioneer Aviation, Airport, Syracuse, N. Y.

AMERICAN EAGLE: Kinner motor; less than 300 hours. Steel propeller, Airwheels. Excellent condition. Sacrifice at $850. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

Bird

BIRD, 100 H.P. KINNER: Excellent condition, dual control, Pioneer instruments, turn and bank, climb indicator, ball bank; airwheels; blue and silver; 120 hours since major. Licensed to September 1937. A real buy, $975. Gus Michelson, Roosevelt Field, Mineola, N. Y.

4-PLACE B-5 BIRD: Engine just majored, including five new heads, all new bearings. Plane just recovered and hand-rubbed finish, chrome plated struts. Equipped with radio, blind and night flying equipment. Akron Airways, Airport, Akron, Ohio.

BIRD KINNER K-5: Front exhaust. No time since complete major on motor, fuselage recovered. Ship finished all yellow. Navigation lights, duals. Priced for quick sale; can finance. "Al" Leeward, New Kensington, Pennsylvania.

KINNER BIRD: 100 h.p. 3-place; new prop and ring; 40 hours since top overhauled; perfect condition. $1,100. Middletown Flyers, Inc., Middletown, N. Y.

BIRD: Kinner K-5, just majored. Ship in excellent condition. Licensed till June 1937. Privately owned. Price, $1,200. Buffalo Aeronautical Corporation, Buffalo Airport, Buffalo, New York.

KINNER K-5 BIRD: Completely overhauled July 1936. Motor majored, wings recovered. Air wheels. Plane in first class condition. $975. Donald Hood, Belmont Ave., Northampton, Mass.

Beech

BEECHCRAFT: 225 Jacobs; 390 hours. Metal propeller, 70 gallons, radio, flares, lights, sensitive altimeter, thermocouples, manifold pressure, parachutes. Jacobs modernized, with new cylinders, heads, crankcase, pushrods 285 hours. Beechcraft factory checked. 14.2 gas, under quart oil per hour. Cost over $10,000; price, $4,995. Hubert Williams, 1086 Seyburn Avenue (Fitzroy 6377), Detroit, Mich.

Boeing

BOEING FLYING BOAT: 6-place cabin job. Wasp motor, 110 hours total. Cruises 105. Licensed and perfect throughout. $4,500. Consider part trade. Paul M. Bradley, 133 South Illinois Avenue, Atlantic City, New Jersey.

Buhl

$425, BUHL PUP: Excellent condition. Total hours, 230. Licensed July '37. Always hangared, flown privately. Airspeed, clock, bank indicator, compass, standard instruments. Burnett, 2042 N.W. 22nd, Miami, Florida.

BULL PUP: Licensed; exceptionally good condition; never cracked; total 30 hours. Consider 1936 car or $450. C. R. Proft, 2621 Seventh St., Port Arthur, Texas.

BUHL BULL PUP: Szekely 45; latest type cylinders; just majored; ship excellent, always hangared, never cracked. Licensed to July 1937. Valley Airways, Inc., Winchester, Virginia.

BUHL PUP: Motor factory majored; relicensed June; special board with full set instruments. Reinforced throughout. Special paint job. $450; will trade. Philip Miraglia, 208 Irvington Drive, Tonawanda, New York.

BUHL BULL PUP: 10 hours since major; just relicensed, $300. W. C. Hartman, Pittsburgh-Butler Airport, Box 470, Butler, Pennsylvania.

BULL PUP: Just recovered; everything put on new. Must be seen to be appreciated; total time since new, 65 hours This was the original Buhl demonstrator. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

Cessna

CESSNA, WARNER 125: New covering; motor 130 hours since overhaul; semi-airwheels, tail wheel; never cracked. Sale, $1,250; will finance. Brayton Airplane Sales, Robertson, Missouri.

125 WARNER CESSNA: Recently recovered, majored, re-upholstered, improved visibility; airwheels, 360 tailwheel, speed ring, other extras. See ship if interested. L. W. Rodehorst, Columbus, Nebraska.

J6-9 CESSNA: Licensed to August, 1937. Good condition. Extra instruments. $1,800 cash. Will accept good open ship part payment. Buck, Crawford Hotel, Carlsbad, New Mexico.

Command-Aire

CHALLENGER COMMAND-AIRE: Excellent condition. Steel prop, starter, Bendix wheels and brakes. Majored year ago. Privately owned, hangared. Priced right for quick sale. Write, wire or visit Jersey Air Service, Paterson, New Jersey.

COMMAND-AIRE: 3-place, OX-5 motor; just relicensed; good condition throughout. A good buy at $550. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

COMMAND-AIRE: Siemens-Halske motor, in good condition. Entire ship now being repainted. Priced for immediate sale, $800. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Penna.

Curtiss Jr.

CURTISS JR.: In good condition; new valve guides, rings, and copper-lead master rod bearing. New paint job. Will trade for factory built house trailer. Claude Richardson, 89 D Street, N.W., Linton, Ind.

CURTISS JUNIOR: Like new, recovered 70 hours ago; motor majored; terms, $150 down, balance easy; will take car trade. For preference wire Pioneer Aviation, Airport, Syracuse, New York.

CURTISS JUNIOR: Completely overhauled steel-barreled motor. No time since refinished and relicensed. Probably the best Junior in the country. Owner leaving for Europe, must sell. $375. Evers, North Beach Airport, Jackson Heights, New York.

Cub

TAYLOR "CUB": J-2, 1936 model; 100 hours, A-1 condition; always hangared. $1,150. Desjardin Auto Service Corp., 181 Grafton Street, Worcester, Massachusetts.

$400 STARTS YOU in aviation with a splendid used Cub. Looks and flies like new, only a year old. Balance only $45 monthly. Flying course included if desired. Don't wait, just wire deposit. We can deliver reasonable distance. Bennett Air Service, Hightstown, New Jersey.

CONTINENTAL A-40-3: Manufactured 6-6-35; Total time 140 hours; licensed to June 15, 1937. Enclosure; excellent condition; $925. J. M. O'Leary, 122 Dix Avenue, Glens Falls, New York.

Why is classified advertising more effective in AERO DIGEST *than anywhere else?*

BECAUSE:

AERO DIGEST publishes 4 times as many advertisements as anyone else, providing buyers and sellers with a much wider selection!

★

FORMS FOR THE BIG OCTOBER ISSUE CLOSE SEPTEMBER 18th.

TAYLOR CUB: Nine months old; A-40-3; total time 190 hours. Never cracked. Sell or trade. Want Monocoupe. Take airplane or automobile. Can finance. John Adams, P. O. Box 1172, Hartford, Connecticut.

CUBS: A-40-2, good condition throughout, $625. Aeromarine Cub, special paint job, 140 hours total, $1,000. 1936 Cub demonstrator, like new, $1,175. Somerset Hills Airport, Basking Ridge, New Jersey.

TAYLOR CUB: 1936 J-2 model with enclosure; A-40-3 Continental motor. No time at all; just manufactured August 10th. Price, $1,400; $400 down and balance monthly. Aviation Finance Company, Hemlock, New York.

1935 TAYLOR CUB: 500 hours. All yellow with black stripes. $850. Neil R. McCray, Fairview, Penna.

TAYLOR CUB: 1½ years old; Continental A-40 engine with 70 hours since major; licensed to March 1937; $900. Will trade or finance. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

WE CAN DELIVER new Taylor Cubs on five minutes' notice. Bennett Air Service, distributors, Hightstown, N. J. See us at Taylor Cub display, Radio City Museum, New York City.

TAYLOR CUB: 1935 Continental AR-3 motor; motor just overhauled, plane relicensed to August 1937. $950. Also new 1936 Cub, $1,275. Smith Flying Service, Wyoming Valley Airport, Forty-Fort, Penna.

ONE CONTINENTAL: Closed; for $950. Also one Continental closed Cub for $850. Both licensed. One used Aeromarine engine. Taylor Aircraft Company, Bradford, Pennsylvania.

Curtiss Robin

CURTISS CHALLENGER ROBIN: 185 h.p. Special rubber motor mount. Tailwheel. 50 hours since major overhaul on motor. Licensed until October 1936. Price, $795. D. W. Cawthorn, 554 North Fourth Street, Newark, New Jersey.

ROBIN OX-5: Standard instruments, semi-airwheels, 150 hours on new engine; duals. One owner. Never cracked, always hangared. $500 includes spare engine. C. R. Putman, Box 439, Pontiac, Michigan.

CHALLENGER ROBIN DE LUXE: No time since major. New oversize tires, puncture proof tubes. Rate of climb, turn and bank, compass, airspeed, clock, landing lights, inertia starter, brakes, battery, flares. Licensed till May 1937. Perfect condition. $995. Box 674, Shreveport, Louisiana.

CHALLENGER ROBIN: Motor 56 hours, new safety glass, upholstery, and tires 16 x 6.00. Hamilton steel propeller, bank-turn, compass, airspeed, tailwheel, brakes, duals, starter. Licensed; $1,075; car accepted. Roy Hume, Arkansas City, Kansas.

CHALLENGER ROBIN: 185 h.p.; 115 hours on engine since new; 10 hours on ship since completely recovered and re-upholstered. Hamilton adjustable steel prop, landing lights, dual controls, and many extras. Licensed to December 1936. $995. Ralph Pretty, 3928 Folsom, St. Louis, Missouri.

CHALLENGER ROBIN: Just completely recovered and engine majored. Best Robin in country. $1,150. We finance and take trades. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Mo.

OX ROBIN: Licensed September, 1937. 100 hours on motor. 30 x 5 wheels. Attractive French gray and yellow Stinson type paint job. $475. Edw. Drapela, Wheatland, Wyoming.

CURTISS ROBIN: Challenger 185. Licensed till April 1937. 50 hours since complete major, ship and engine. $950; terms and trade. Airplane Sales Corporation, Robertson, Missouri.

CHALLENGER ROBIN: Motor, ship, controls and all fabric excellent condition. Motor 325, ship 415 hours. Owned and operated exclusively by Curtiss Aircraft to April 1936. Now privately owned. Complete instruments, including turn and bank; tailwheel, starter, brakes, Curtiss-Reed metal propeller. Bargain, priced quick sale, $975. Wm. J. Ray, 315 Broadway, Buffalo, New York.

CHALLENGER ROBIN: Perfect condition. Not over 50 hours on motor since major overhaul by approved Wright service. About 330 hours on ship. Fully equipped. Brakes, lights, rate climb, turn bank, air speed, duals, steel prop, inertia starter. $1,500 or will exchange for good motor boat cruiser, 38-footer preferred. J. Hagan, 377 No. Pearl Street, Albany, New York.

Curtiss-Wright

CURTISS-WRIGHT SPORTSTER: 165 Wright E-type motor. Excellent condition. Albany Aircraft Company, Albany Airport, Albany, New York.

Davis

DAVIS: LeBlond 65; excellent condition; 350 hours. Just overhauled, recovered and relicensed. Two-place, tandem, monoplane. Dual controls. $750 cash. Willis Kysor, Niles, Michigan.

WARNER DAVIS: Like new; low total hours, engine just topped; will sacrifice for $1,175 cash. Extras. AERO DIGEST, Box 2389.

Driggs

ROVER-POWERED DRIGGS Skylark: Hand-rubbed Loening yellow finish on fuselage and wings, equipped with brakes and all necessary flying and engine instruments; 50 hours time since turned out by factory. Price, $1,000. G. D. Owsley, Glenview, Illinois.

Eaglerock

EAGLEROCK A-2: Center section type; OX-5 with Hamilton Standard adjustable steel propeller, Miller overhead, brake equipment. Good flying condition. $250. A. E. Nolan, 2206 Stuart Avenue, Richmond, Virginia.

EAGLEROCK: Hisso-powered. Just completely recovered. Brand new engine installed. Absolutely perfect. $550; $275 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

EAGLEROCK A-3: Hisso 150. Identified; $350 or trade for light plane. Barling NB-8, Genet 80; licensed, $500; will trade. Ben A. Funk, Grover, Missouri.

Eastman

EASTMAN AMPHIBION: Licensed to May, 1937. Electric starter. Only 3 hours since complete major on Challenger engine. $1,650. $800 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

Fairchild

FAIRCHILD 24: With flaps. Available October first, fully equipped, almost new. Bargain. AERO DIGEST, Box 2386.

Fairchild

FAIRCHILD: 3-place cabin plane with flaps. 145 h.p. Warner motor. About 200 hours total time. Bonded and shielded for radio. Purchased year ago. Cost nearly $6,000. Owner willing to sacrifice for $4,150. AERO DIGEST, Box 2390.

CHALLENGER KR-31: OX-5. 15 hours since overhauled. Relicensed August 1936. Wings recovered; entire ship reconditioned, $450. Air wheels, steel prop. Irvin seat-chute, water-cooled Tank extra. Would trade for light ship. George LeNorth, Linden, New Jersey.

A REAL BUY: Nearly new, slightly damaged Warner Fairchild 22, with or without Warner motor. Submit your proposition. Michigan Aero Motors, Jackson, Michigan.

FAIRCHILD 22: 125 Warner; 50 hours since complete major. Airplane in excellent condition. Akron Airways, Airport, Akron, Ohio.

1936 SERIES, RANGER-powered Fairchild 24 demonstrator, with only a few hours total time. Bargain for quick cash sale. Air Activities, Inc., Municipal Airport, Houston, Texas.

FAIRCHILD 24: Cirrus. 500 hours. 53 hours since motor major. Turn and bank, rate of climb instruments. Splendid condition. $1,500 cash. H. E. Horner, 633 Moss Avenue, Peoria, Illinois.

CHALLENGER: Millerized OX-5 with steerable tailskid; just relicensed, excellent condition. Priced to sell. E. Amanuel, Corcoran Courts Apt., Washington, D. C.

FAIRCHILD KR-31: OXX-6 motor in good condition. Also Waco primary glider. Both for $300. Barney's Air Service, Gorham, New York.

FAIRCHILD 22: Inverted Cirrus motor, just overhauled; navigation lights, compass, bank indicator. $1,350. Smith Flying Service, Wyoming Valley Airport, Forty-Fort, Pennsylvania.

Fleet

FLEET DE LUXE: 125 Kinner, 2 place, 40 hours since major. Licensed June 1937. Never damaged. Full set instruments, brakes, starter, tail wheel, Hamilton prop. Covering excellent. Wings re-doped. Sacrifice $1900 Cash. Roberta Lupton, 1035 First St., Detroit, Mich.

KINNER FLEET: K-5 motor. New B-5 heads. Ship and motor just overhauled; little time; like new. Priced to sell. Columbia Airways, Bloomsburg, Pennsylvania.

WARNER FLEET 125: Ship completely recovered and reconditioned, and motor majored 35 hours ago; high lustre finish; full air wheels. Price, $1,500. Northern Air Service, Duluth, Minnesota.

Franklin

1932 FRANKLIN SPORT: Lambert 90 motor. Oleo landing gear. 200 hours total time. Excellent condition. $975. Neil R. McCray, Fairview, Penna.

Great Lakes

FOR SALE: Great Lakes 2T1E; steel prop, airwheels, etc. Standard steel propellers and hubs for Wasp, Hornet and Cyclone. Wasp parts. Very cheap. Box 1457, Tampa, Florida.

GREAT LAKES: NEW 2T1A; serial number 249; ATC number 228. Goodyear wheels, brakes; International orange rubbed dope job. Price, $1.950. Aircraft Service, Inc., Municipal Airport, Cleveland, Ohio.

GREAT LAKES 2T1A: Air wheels, military windshields, standard instruments, covering less than year old; motor 300 hours. $1,000. Don Walters, Norton Field, Columbus, Ohio.

Heath

FOR SALE: L. N. Heath B. 4. Factory built, slightly damaged. This ship is priced to sell. Also Russlobe parachute. AERO DIGEST, Box 2383.

Kari-Keen

KARI-KEEN: Lambert 90, excellent condition, 460 hours. Air wheels and air speed. $900. Will take Taylor Cub in trade. AERO DIGEST, Box 2380.

Lambert

LAMBERT MONOCOUPE: Like new. Electric starter, Pioneer clock, speed ring, bank and turn, rate of climb, pants, heater, booster, duals and other extra equipment; painted Stearman vermilion, black trim. 40 hours since factory major. License expires August 1937. Total time 260 hours to date. Price $1,495, no less. Will trade on late Cessna. Clyde J. Bristow, 6203 Monitor, Pittsburgh, Pennsylvania.

VELIE MONOCOUPE: perfect condition, airspeed, bank indicator, hand-rubbed finish. An exceptional buy at $450. V. E. Millard, 824 Belmont, Chicago, Ill.

FOR SALE: Monocoach, Wright J-5. Total time on ship and motor, 372 hours. Privately owned since new. Always hangared. Leather upholstery. Steel propeller. 30 hours on motor since completely majored. Priced right for quick sale. C. A. Morris, 256 Alta Vista Avenue, Waterloo, Iowa.

VELIE MONOCOUPE: Licensed June, 1937. No time since majored, recovered, newly upholstered. $450 cash. Will accept car in trade. Lynn Cook, 1515 You St., N. W., Washington, D. C.

VELIE MONOCOUPE: Just relicensed. Beautiful blue and red paint job. $550; $275 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

1933 WARNER MONOCOUPE: 125 h.p. Very fast and in perfect condition; ring, pants, radio, blind instruments plus hood; racing landing gear; many more extras. Priced for quick sale. Bill Reedholm, Paton, Iowa.

LAMBERT MONOCOUPE: De luxe late 1934; flaps, tunnel cowl, parking brake, duals, lights, tail wheel. Total 390 hours. Perfect condition. $2,000. Silver Star Airport, Langhorne, Pennsylvania.

MONOCOUPE LAMBERT: 1934-5; total time 130 hours. Has been flown privately. In beautiful condition throughout. Located Teterboro Airport. Price. $2,300. Standard Air Service, Hackensack, N. J.

VELIE MONOCOUPE: $550. cash. 20 hours since major. Licensed in August. Always hangared. never cracked. Air speed, compass. bank; ventilators. Boulevard Airport, c/o Art J. Mostyn, Philadelphia, Pennsylvania.

LA SALLE MONOCOUPE: 10 hours since newly recovered. motor completely overhauled: wonderful performer. Fully guaranteed. Will sacrifice at $295. Loyal Klock, 323 East Water St., Austin, Minnesota.

LAMBERT MONOCOUPE: Delivered new May 1933. Equipped racing type landing gear. pants. heater. engine cowling. collector ring. Exide 12-watt battery, RCA radio for beam or broadcast. running lights. rate of climb. turn and bank. and compass. Complete overhaul with standard kit. including new barrels. pistons, rings and beads. just completed. Ship always privately owned and hangared; never cracked or nosed over. Fabric in perfect condition. Highest offer over $1,850 takes ship. as owner is buying larger airplane. Write or wire Esmond Avery, 5172 St. Jean, Detroit, Michigan.

MONOCOUPE: Velie 65 engine that has just been overhauled. Black fuselage and orange wings. Fahlin wood propeller. $550. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

MONOCOUPE LAMBERT: $1 800. Late Velie, $685. Warner. $1,150 (will take trade). Pioneer Aviation. Airport. Syracuse, N. Y. They have better planes for less. Terms arranged.

LAMBERT MONOCOUPE: Motor factory rebuilt. steel propeller, brakes, air wheels, never damaged, privately owned; 355 hours. $1,525. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

Lincoln-Page

LINCOLN-PAGE: OX-5. 3-place open biplane. Licensed until August, 1937. Millerized. New prop. Always hangared. Never cracked. Plane and engine excellent condition; only 300 hours total time. Buying closed ship. Real bargain at $425 cash. Wire or write B. F. Hennacy, 3265 Colerain, Cincinnati, Ohio.

Loening

LOENING COMMUTER: Excellent condition. Hamilton Standard controllable propeller. New E-type Wright motor. approximately 100 hours since new. New battery. Albany Aircraft Co., Albany Airport, Albany, New York.

Lockheed

LOCKHEED VEGA: Wasp C. Motor has 20 hours since complete major and modernized at Pratt & Whitney factory. Hydro conversion for controllable propeller. Kollsman sensitive altimeter, bank and turn, rate of climb, Sperry gyro compass, Sperry horizon, generator, starter, R. C. A. radio, new pants, semi-air wheels, vacuum pump, thermocouples, carburetor temperature, 186 gallons gasoline. Total ship time, 260 hours; engine time 199 hours. Columbia Airways, Bloomsburg, Penna.

Moth

DH MOTH: 2POLB, licensed August, 1937. Good condition; cheap for cash. Will take light plane, auto, motorcycle. Norton Field, Columbus. Paul Souder, Gahanna, Ohio.

GIPSY MOTH: Excellent, unlicensed. Special, $550. Arrow Sport, Velie, $500. Monoprep oleo landing gear, $15. Eclipse 4-H-4 starter, $25. Consider trades on ships, motors. Kidd, Box 195, San Antonio, Texas.

GIPSY MOTH: 10 hours since recovering. Ship and engine perfect. $795; $375 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

FOR SALE: Cracked DH Moth, $250. Will sell any part Gipsy engine, in excellent condition. Jesse Jones, Lancaster, Pennsylvania.

N-B Trainer

BARLING NB-3: Genet-powered, 3-place. Just recovered and re-upholstered. Engine just majored; pitch indicator, ball bank indicator; clock. $795; $395 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

New Standard

J-5 NEW STANDARD: 5-place. Motor just overhauled; plane and covering excellent condition, low hours. Brakes, tail wheel, complete night flying equipment. Had the best of care. Will trade. Harold Clobes, Marshall, Minnesota.

Pheasant

PHEASANT OX-5: Completely rebuilt; excellent condition; licensed; equipped with wheel pants. Exceptional bargain for cash. $450. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

Porterfield

1936 PORTERFIELD: LeBlond 70, extras include dual brakes, speed ring, tail wheel, compass and air speed; total time ship and motor 51 hours, used for demonstration only. Price $1700. Bush, 5214 W. 63rd St., Chicago, Ill.

PORTERFIELD: LeBlond 70. Demonstrator. 100 hours total time. Perfect condition, special finish; speed ring, compass, air speed. Trades considered. $1,350. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

BARGAIN: Porterfield LeBlond; 11 months old. Speed ring, compass, air wheels, duals, dual brakes, rate of climb, airspeed, bank indicator; less than 100 hours; $1,450. Lester Jolly, Devils Lake, North Dakota.

Rearwin

REARWIN SPORTSTER DEMONSTRATOR: 70 LeBlond, streamlined wheels and brakes, exhaust collector and carburetor heater, speed ring, compass and air speed. Less than one hundred hours and condition like new. Licensed until June 1937. W. Harvey Couch, 741 Main St., Stamford, Conn.

REARWIN SPORTSTER: Late '35 LeBlond 70; best in country; 85 actual hours. Never damaged. Has collector ring, latest type brakes, air speed, lights, tail wheel. Due to rise in price, plane like this now delivers for $2,700. Owner will sacrifice at $1,675. Take car in trade. Jones Repossessions, 121 Alexander Street, Rochester, New York.

REARWIN SPORTSTER: LeBlond 70; many extras; like new; cost over $2,600; will sacrifice for $2,100. Must be seen to be appreciated. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

REARWIN JUNIOR: Aeromarine 50 engine with 35 hours since major; plane being recovered and relicensed. $800. Will trade or finance. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

Ryan

RYAN B-5: J6-9. 120 hours since major overhaul of motor. Plane in fine condition. Completely equipped for aerial mapping. Price, $1,500. Now located Omaha, Nebraska, Airport. Ryan B-3: J6-9. 100 hours since major overhaul of engine. Plane just reconditioned and relicensed for one year. Completely equipped for aerial mapping. Climb to 18,500′ in 40 minutes. $1,400. Now located at Bloomington, Illinois, Airport. Owned by Standard Air Service, Hackensack, New Jersey.

Savoia-Marchetti

SAVOIA MARCHETTI amphibion: Model S-56-B. For sale. Just relicensed. Completely renovated and just repainted. Several improvements over the stock model. Price, $1,500. Seversky Aircraft Corporation, Farmingdale, L. I., N. Y. Telephone, Farmingdale 691.

States

STATES MONOPLANE: K-5 Kinner, majored, new pistons, master rod bearing; two Gardner propellers for extra take-off performance and efficient cruising; air wheels, brakes, landing, position lights, radio, airspeed, clock, hood for blind instrument training; special streamlining; finished fire-proof white Bakelite; excellent performer; $1,275 cash or will pay difference for late Lambert Monocoupe or Rearwin. Wesley Brubaker, Freeport, Illinois.

STATES MONOPLANE: Kinner K-5. Practically new, 120 hours; steel prop, air wheels. Ideal sportsman or training ship. $1,550 or trade for jam-up J-5 open job. D. R. Watson, 6643 Rutgers Street, Houston, Texas.

Stearman

FOR SALE: J-5 Stearman, in perfect condition. Licensed to August, 1937. Has speed ring, metal prop, brakes and tail wheel. Will accept best cash offer. Albert Grazioso, 647 Valley Road, Clifton, New Jersey.

Stinson

STINSON JR. SM8D: Packard Diesel; 490 hours total. Airwheels, radio, licensed; instruments, perfect. $900 or without motor. Elmer Jones, 61 N. Washington, Wilkes-Barre, Pennsylvania.

STINSON LYCOMING SM8A: 125 hours since good major; $1,200, licensed. Stinson Jr., Wright J6-9, recently overhauled, licensed. $1,200. Link Aeronautical Corp., Binghamton, New York.

LATE MODEL SR-5 Stinson, like new. Powered with Wright E-type 250 h.p. motor. Everything on it. Priced to sell. Edw. A. Forner, Jackson, Mich.

STINSON J-5: 6-place. Just recovered, completely overhauled; very attractive. Finished International orange, trimmed blue. Tail wheel. Wonderful performer. Indiana Air Service, Airport, South Bend, Indiana.

STINSON JR. (SM7B): Wasp Jr. (300) powered. Ship and engine in A-1 shape. Licensed until June, 1937. Starter, generator, navigation and landing lights, flares, bank and turn, rate of climb, air temperature, clock, radio, ring, pants, etc. Approximately 565 hours total, including 75 since major. Best cash offer this month takes it. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

TRIMOTOR STINSON T airliner; 20 hours since complete major and modernization of motors, transport shafts, forged pistons, etc. Ship relicensed and completely checked. Over $1,000 spent putting ship in A-1 condition. Ship has high gloss Stinson finish, red and cream; all leather interior. Electric starter, generator, radio, cabin heater, full night equipment; bank and turn, climb, etc. Spare Airwheel, hub, tail wheel. Priced for quick sale. Wire "Al" Leeward, New Kensington, Pennsylvania.

TRIMOTORED STINSON: Model T. Just off an airline and completely equipped for airline use, including electric starters, turn and bank, rate of climb, landing lights and flares. $2,650. Will finance or take trade; or will take your ship and finance the balance. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

FOR SALE: Stinson SM8A. 735 hours complete time; 7 hours since major overhaul on motor, 77 hours since major overhaul on airplane. Lycoming 215, excellent shape; all instruments; $1,750. Travel Air 2000: 100 hours since major overhaul; OX motor; $500. Both relicensed until July 15, 1937. J. O. Juvrud, Roseau, Minnesota.

STINSON RELIANT SR-5A: $3,950. New October 25, 1934. Has low flying time, controllable pitch propeller, air flap, directional gyro, radio, ice warning indicator, landing lights, airport lights, air speed indicator, wheel pants and set of mudguards, dual controls, clock, Pioneer turn and bank, rate of climb, and many other extras. Act quick. Prohinsie, Pontiac dealer, 226 Main Street, Hempstead, L. I. Telephone: 130.

SPECIAL STINSON Model R: Built for executive use, with down cushions, reclining rear seats, whipcord upholstery; total time 398 hours, 128 since engine major overhauled by Lycoming service station; retractable landing lights, bonding, shielding and Lear radio; 75-gallon tanks; color International orange and gray; entire ship rubbed finish. Price, $2,250. G. D. Owsley, Glenview, Illinois.

STINSON "U" TRIMOTOR: Three J6-7-E motors. Only Wright-powered Stinson in world. Only 700 hours. Latest model; soundproof. $4,750. Western Airplane Distributors, 600 Graphic Arts Building, Kansas City, Missouri.

W*hy is classified advertising more effective in* AERO DIGEST *than anywhere else?*

BECAUSE:

AERO DIGEST reaches the buyers and sellers earlier every month!

★

FORMS FOR THE BIG OCTOBER ISSUE CLOSE SEPTEMBER 18th.

1936 STINSON: 60 hours time. Completely equipped, every detail: lights, flares, instruments, bonding, shielding, antenna, adjustable propeller. Best cash offer over $7,000. Cost $8,800. AERO DIGEST, Box 2397.

STINSON SM8A: 230 hours since modernization; new tires, battery, landing lights; never damaged; fabric and interior excellent. Sacrifice, $1,450 or trade on late Reliant. Mankato Air Service, Mankato, Minnesota.

STINSON S: Modernized Lycoming, recently majored; large fuel tanks, retractable landing lights, fenders, ring, bank and turn, rate of climb, thermocouple, manifold pressure, carburetor heat, new Crosley radio. Ship formerly owned by Merrimac Chemical Co. and is in good condition. Price, $1,950. Arthur Beaudoin, Box 237, Leominster, Mass.

STINSON SR: 70 hours since majored; Sperry horizon and gyro, Kollsman altimeter, turn and bank, rate of climb, radio, night equipment; $2,875. W. C. Hartman, Pittsburgh-Butler Airport, Box 470, Butler, Pennsylvania.

STINSON: Lycoming, $1,200. J-5, $1,100. Warner, $885. Reliant, $3,500. Terms arranged. For preference wire or special Pioneer Aviation, Airport, Syracuse, N. Y. Terms. Pay balance monthly.

STINSON RELIANT: Late 1935 SR6; motor just overhauled, plane relicensed; bank and turn indicator, flares, landing lights, radio, camera door, large 75-gallon tanks, parachute door. $5,750. Smith Flying Service, Wyoming Valley Airport, Forty-Fort, Pennsylvania.

STINSON S: Lycoming, late type, just overhauled. New covering, finished glossy black and silver. New leather upholstering. Completely equipped with starter, battery, retractable landing lights, flares, radio, dynamo and blind flying instruments. Perfect condition and a bargain at $2,250. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

STINSON SM8A: Motor recently factory overhauled, modernized. Landing lights, flares, 60-gallon tanks; fabric, finish, excellent condition. Real bargain, $1,490. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

STINSON SM8A: Excellent condition, motor majored; color red and white; $1,100. Lambert motor, just majored, with etched steel prop, a real buy, $350. Bismarck Flying School, Bismarck, North Dakota.

Waco

WACO CABIN: 170 Jacobs; steel prop, Heywood starter, $1,750. Waco Cabin: 165 Continental, steel prop, Heywood starter, $1,600. Waco F: Warner Scarab 125; wood prop, no starter, $1,100. All three ships in first class mechanical condition and always hangared. Take all three, $4,000 cash, subject to prior sale. Morris-Hinkle Airways, Inc., Borderland, West Virginia.

WACO 10 OX-5: Licensed; excellent condition. Will sell for $450 cash or trade for late type Velie Monocoupe. Frank Slavin, care Pontiac Airport, Pontiac, Michigan.

WACO F: Powered with Warner 125 motor. Steel prop, balloon tires, covering excellent. Guarantee in first class shape. Price, $1,450. Will finance responsible parties. Deliver for expenses. L. E. Smith, Box 564, Sterling, Colorado.

WACO A: Jacobs 170. Motor 165 hours. Rubbed finish, black with yellow wings. Perfect condition. Radio, landing lights, bank and turn, steel propeller, winter enclosure, heater. Privately owned, always hangared. $2,000. Will consider trade for late Waco F Kinner. Ellen Smith, Box 334, Meadville, Pa.

WACO 1935 Custom Cabin, Jacobs 225 h.p. Wonderful condition. Extras: 70-gallon gas tanks, manifold pressure gauge, landing lights. Special paint job, blue trimmed in cream, very attractive. RCA Radio. Wheel pants. Cost over $7,700; sacrifice $4,950. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

JACOBS STANDARD WACO Seaplane on new Edo floats: Equipped with many extras, licensed on land or water. $6500. Only 3 months old. AERO DIGEST, Box 2384.

WACO: MODEL CUC: 285 Wright, controllable prop; radio, large 95-gallon gas tanks, all instruments. Privately owned. Time 120 hours. Cost $11,000; price $6600. AERO DIGEST, Box 2385.

WACO J5 ASO Straightwing. Matched Pioneer instruments complete, altimeter and airspeed in front cockpit. Ship completely recovered, finished in sunset orange; also new upholstering. Engine about 75 hours since top overhaul cost $165. Engel speedring. Electric starter, float fittings, steel propeller. Licensed May, 37. She's a producer—first $1250 takes her. Speed Engel, 15438 Harper, Detroit, Mich.

WACO F: 125 Warner, 31 hours since major, total time ship and motor 550 hours. Hamilton steel prop, Heywood air starter, wings and tail surfaces recovered. Priced $1550. Bush, 5214 W. 63rd St., Chicago, Ill.

1936 WACO Custom demonstrator, 285 hp Jacobs, radio and extras; less than 75 hours on ship and motor. Will consider trade on Waco F3 or F5. AERO DIGEST, Box 2387.

WACO CONTINENTAL 165, F-2: Never cracked. In new condition throughout. Heywood wheel pants, speed ring, etc. Honest 485 hours. Always hangared and perfectly cared for. Recovered and refinished, engine majored. Will sacrifice for $1,975, worth $2,300. As last resort may consider light popular car in trade and finance reasonable balance. You'd better wire or phone I. Walter Sell, 566 Vine Street, Johnstown, Pennsylvania.

WACO 10 OX-5: Licensed to April 1, 1937. Recovered and majored March. Color cream and orange, high gloss. A real buy. Cedar Rapids Airways, Cedar Rapids, Iowa.

WACO CUSTOM CABIN: Jacobs engine; demonstrator. Fully equipped, including three-band radio and transmitter. Also ambulance stretcher. Best buy in state of Ohio. Akron Airways, Airport, Akron, Ohio.

TAPERWING WACO: J-5. Latest model. Tail wheel, front cockpit cover, speed ring, high gloss finish, just relicensed and in excellent condition. Akron Airways, Airport, Akron, Ohio.

WACO F-2: 165 Continental. Landing and navigation lights, air starter, full set instruments; excellent shape. Priced to sell. Columbia Airways, Bloomsburg, Pennsylvania.

WACO CABIN SEAPLANE: Edo floats; Continental 210, less than 50 hours since motor majored, sodium valves installed. Night flying equipment. Will sell ship on floats or wheels. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

WACO CUSTOM CABIN: Jacobs-powered. Five-place. Starter, turn and bank, rate of climb, Kollsman altimeter, landing lights, flares, large gas tanks. Five months old. 95 hours total. $5,995. We finance and take trades. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

J-5 WACO: Just recovered and engine just majored. Licensed to June, 1937. $1,275. Will finance or will take trade and finance remainder. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

WACO 10 GXE: Millerized; OX-5 recently overhauled, 1400 r.p.m. on ground. Good covering, full airwheels. Identified. $325. John Finta, 1061 Mason, Warren, Ohio.

WACO 1932 CABIN: Excellent condition; Continental 210; metal prop, bank and turn, rate of climb, $1,900. James Whittall, Brussels Street, Worcester, Mass.

WACO C 165: Lights, flares and recovered, $1,850. Have cash for later model cabin, OX-5 Waco, Travel Air, Bird, also air-cooled three-place job. Enclosure and parts for Fleet, Kinner K-5 motor and parts. Lloyd Pierce, 2629 Fox Ave., Fort Wayne, Indiana.

'34 WACO CABIN: 225 Jacobs, under 500 hours time; majored at factory. Many extras, special paint. $3,500. Bush, 5214 West 63d Street, Chicago , Illinois.

FOR SALE: Waco F-2, 210 Continental; total time, 649 hours; motor converted by factory to Series C. 140 hours since overhaul. Recovered last January. Extras include metal propeller, wheel pants, wing root fairings; shielded for radio; 14-gallon extra gas tank, landing lights, flares. This beautiful Detroit Air Show job has been privately owned. Price, $2,600. J. Sydney Maxfield, 420 N.W. 17th Street, Oklahoma City, Oklahoma.

WACO CABIN: 1936 Standard; Jacobs-powered. Only 70 hours use since factory delivery six weeks ago. Perfect condition. About $1,400 extra equipment included. Westport radio receiver, full electric night flying equipment, de luxe upholstery, steel prop. Blue wings, fuselage. Cost $6,450. Sacrifice for $5,300. J. B. Steinel, 525 Flynn Building, Des Moines, Iowa.

WACO MODEL F: Warner-powered. Steel prop. Write or wire Gillie Jackson, Municipal Airport, Kenosha, Wisconsin.

WACO 10 OX-5: Licensed to June 1937. Extra good condition, never cracked; always hangared. 30 x 5 wheels, lots of extras; spare engine. Will sell or trade on J-5 or J6-7 Standard. Waco or Travel Air. Aerial Transit Company, 125 N. Logan Ave., Danville, Illinois.

WACO A: With 210 Continental; full night flying equipment, speed ring, turn and bank and rate of climb indicators, 60-gallon gasoline tank; will be relicensed to September 1937. $2,395. Will trade or finance. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

TANK 63 WACO: 115 h.p. Motor has only 50 hours since new. Plane just overhauled. Full airwheels. LaFleur Airport & Flying Service, Northampton, Massachusetts.

WACO STRAIGHTWING: $1,200; with floats, $1,950. Taperwing, $1,150. Cabin, $2,500. OX-5, $485. For preference, wire or special Pioneer Aviation, Airport, Syracuse, New York.

WACO F: Warner 125. De luxe equipment includes rate of climb, turn and bank, compass, air speed, speed ring, lights. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

WACO F, KINNER B-5: Five new heads; Heywood starter; black with red wings; 450 hours. $1,625. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO F, KINNER B-5: Five new type heads; black and orange. Always hangared. $1,175. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO CABIN: Jacobs 225; 418 hours total time. late 1934 ship; no time on engine since major and modernized, as 1936 engine; special rubbed finish, vermilion trimmed in black and gold; pants, air brakes, starter, generator, landing lights, flares; 70 gas, clock. Excellent condition. $3,750. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO 1935 CUSTOM CABIN: Jacobs 225. New 1936 engine; beautiful finish, 95 gas, pants, red leather upholstery, bank and turn, rate of climb, Kollsman, radio, landing lights, flares, metal propeller, starter, generator, vacuum flaps. Excellent condition. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

Travel Air

GIPSY TRAVEL AIR: New covering, new prop, 650 x 10 air wheels, brakes, tail wheel, bank and turn, climb, compass, airspeed, cockpit hood, all instruments luminous. 80 hours on motor since major. Total time 340. Make offer. Newton E. Vance, Jr., 502 West Valley St., Shenandoah, Iowa.

TRAVEL AIR 2000: Millerized OX5, motor like new. Brakes. Licensed to May 1, 1937. Ship in perfect condition, never cracked. Bargain at $550. M. L. Powell, 1049 South 29 St., Omaha, Nebr.

TRAVEL AIR 10-D: 4-place cabin monoplane, Wright J6-7, 350 hours flying time; in excellent condition. Price, $1,500. Canaan Airport Co., Inc., Canaan, Connecticut.

TRAVEL AIR 2000: OX-5. Speed wing. Bolted motor. High compressioned and Millerized. Speed prop. Extra motor and prop, all for $495. John M. Werstcoffer, Aurora, Illinois.

TRAVEL AIR E-4000: Speedwing; J6-5, completely modernized, 50 hours since major. Air wheels. new fabric, excellent condition throughout. Rubye Berau, Municipal Airport, Akron, Ohio.

HISSO 180 TRAVEL AIR: High gloss finish, navigation lights, complete blind flying instruments, steel prop, 30 x 5 Bendix wheels, brakes, Scintilla magnetos, Stromberg carburetor; 75 hours since major; licensed till 1937. Arthur Hyde, Congressional Airport, Rockville, Maryland.

TRAVEL AIR: Model 2000. OX engine with Miller action; new Supreme propeller; recovered last summer. 30 x 5 Bendix non-brake type wheels; detachable engine mount; licensed to April 1937, $650. Will trade or finance. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

TRAVEL AIR OX-5: Licensed August, 1937; motor and ship in good condition, new prop; $450. Trade for late Ford, Monocoupe or air-cooled crack-up. Russell Byer, Willshire, Ohio.

J-5 SPEEDWING TRAVEL AIR: Finest Travel Air in America. Oleo shock struts, speed ring, tail wheel, Friez ailerons, turn and bank, 116-gal. gas capacity. Covering excellent. Just relicensed. Blue fuselage, orange wings. Total engine time, 325 hours. 60 hours since major. Price $1,350. R. C. Helfrich, 2463 Fulton Street, Toledo, Ohio.

Miscellaneous Aircraft

Aeronca, Air King, American Eagle, Aristocrat, Arrow, Avro-Avian, Barling, Bellanca, Bird, Cessna, Command-Aire, Cub, Curtiss Robin, Curtiss-Wright, Driggs, Eaglerock, Fledgling, Fleet, Howard, International, Laird, Lambert, Lincoln Page, Lockheed, Moth, Pitcairn, Privateer, Rearwin, Ryan, Sikorsky, Stearman, Stepanich, Stinson, Swallow, Travel Air, Waco, Whittelsey.

ROBIN CHALLENGER: Less than 20 hours since majored. Ship completely rebuilt, reconditioned steel propeller, oversize tires. $1,300. B-5 Kinner Bird, good condition. $1,200. J-6-7 Waco Straitwing. Just relicensed, good fabric, motor 75 hours since major, $1,600. Want good trainer. Approved Repair Station No. 260, Springfield Airport, Springfield, Mass.

SALE OR EXCHANGE: 10 certified airplanes: 1 J6-9 Stinson, airwheels; 1 J6-9 B-5 6-place Ryan cabin ship; J6-9 330 h.p. Travel Air cabin ship, airwheels; 1 Wasp-powered 7-place Stinson cabin ship; 1 J-5 Cessna cabin ship; 1 J-5 Speedwing Travel Air; 1 type 2000 OX-5 Travel Air; 1 OX-5 Laird; 2 J6-9 Pitcairns, with or without motors; many extras. 1 OX-5 Waco 90. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

WACO F-2; Waco F; Hisso Eaglerock; Moth; Avro-Avian; Travel Air 6000; Kinner Bird; others. Wanted: Wasp job, less engine. Have parts for Kinner, Gipsy, Cirrus, J-5, J-6, Wasp and Hornet motors. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

FOR SALE: Taylor Cub, 2 months old; 40 hours; $600. cash; balance, $76 month, 10 months. Waco B.S.O. J6-5. No time since $450 major; just relicensed; $1,800. Wilbur Horn, 3566 Cedarbrook Road, Cleveland Heights, Ohio.

BARGAINS: Fairchild 24, early '35 model with bank and turn, rate of climb and landing lights. Less than 290 hours and in the best of condition. Fairchild 22 trainer, with brakes and blind-flying instruments in both cockpits, radio and blind-flying hood. Waco, 3 POLB, with 165 h.p. Wright; less than 100 hours on airplane and engine. Also good used Irvin and Switlik parachutes, priced for quick sale. Air Activities, Inc., Municipal Airport, Houston, Texas.

TWO REPOSSESSED Taylor Cubs: 1935 A-40-2 Continental. Locations, Georgia and Hemlock; $1,000, $200 down. Ryan 5-place J-5 cabin monoplane, just recovered, motor majored, $1,600; $500 down. 1936 Porterfield, absolutely like new, $1,500; $500 down. Two 1935 Porterfields, little time, $1,100; $300 down. Savoia-Marchetti amphibion, Kinner 100 h.p., $850; $300 down, balance by monthly payments. Also Lycoming, Cirrus, J6-7 and Cub Continental motors and 1933 Stinson Reliant, Sikorsky S-38, Taylor Cub, Klemm and Avian airplane parts. Also Sperry artificial horizon, $100. All motors and parts offered no down payment plan. Aviation Finance Co., Hemlock, New York.

TAYLOR CUB; Travel Air J6-5; Aeronca C-3; Stinson SM8A. All licensed and in excellent condition. Cincinnati Aircraft Service, Lunken Airport, Cincinnati, Ohio.

HUNDREDS OF PLANES: OX-5 jobs, $75 up. Terms, trades. Send 25c for complete Directory containing owners' prices, names and addresses. Used Aircraft Directory, Athens, Ohio.

SALE OR TRADE: Eaglerock J-5, just relicensed; high compression motor; excellent condition; wonderful performance. American Eagle, long nose, like new; just relicensed. Want Cessna. Edward Kersten, DePere, Wisconsin.

DE LUXE FLEET: Kinner B-5; 2-place; air starter; A-1 condition; motor 50 hours since major; brakes, semi-air wheels, tail wheel, steel prop. 291 hours total. Licensed to August, 1937. $1,900. Fleet 2, Kinner K-5: Splendid condition; motor just majored, semi-air wheels, brakes unhooked, steel prop. Licensed October 15, 1936. $1,250. H. Leonard Lundquist, Wayne County Airport, Romulus, Michigan.

CIRRUS GREAT LAKES: Engine majored, new covering, new prop, $950. J-5 6-place Stinson, excellent covering. $925. Cirrus Avro-Avian, no time since major, $550. Velie Cavalier, practically new cover, $650. 1935 enclosed Taylor Cub, $900. J-5 Travel Air, $1,000. Southern Aircraft Sales, 216 Milam Street, Shreveport, Louisiana.

WACO J-5: Waco ASO Straightwing; 25:00 on engine since completely reconditioned; no time on propeller since reconditioned by Ford factory; total time on airplane since new, 80:00; no time since completely recovered and finished; wings and fuselage Stearman vermilion, black stripe. New motor mount complete; new landing gear; brakes, wheels, tires and tubes; never cracked. Total time certified. Have pleasure of owning airplane which is practically new. Price, $1,450. Will finance 40%. Waco A: Late 1933 Jacobs; 20:00 since major; radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition; will consider trade. Lambert Monocoupe: Engine completely major overhauled; recovered and finished in high-lustre, entire ship; special engine ring and pants; special leather upholstering; left door installed; tail wheel. Price, $2,200; finance 40%; consider trade. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

GEE BEE BIPLANE: Starter, tail wheel, brakes, just relicensed. Curtiss Junior: Being recovered and overhauled. J-5 motor with starter and speed ring. J-5 Standard steel prop. J-5 Hartzell wood prop. 3 Irvin chutes, two quick-connector and one seat pack. Clarence L. Washburn, 222 Oak Grove Ave., Springfield, Massachusetts.

AERONCA: $700. 1935 Taylor Cub, $850. OXX-6 Robin, $485. OX-5 Travel Air, $475. Cirrus Avian, $550. Challenger Robin, $850. For preference wire Pioneer Aviation, Airport, Syracuse, New York.

KINNER BIRD: $1,050. Fairchild FC-2, $950. Warner Command-Aire, $875. Aristocrat cabin, $885. Waco F, $1,350. New Standard, Kinner Fleet; terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

REPAIRABLE WRECKED PLANES: OX-5 Command Aire, $150. Waco, $175. Klemm, $300. J6-7 Travel Air, many others. Inspection by appointment only. Pioneer Aviation, Airport, Syracuse, N. Y.

J6-9 CURTISS OSPREY; Jacobs, Waco; J6-5 Waco; Warner Waco; OX Waco; J6-5 Travel Air; OX-5 Travel Air; Great Lakes; Warner Cessna; Lambert Monocoupe. We finance and take in trades. Jack's Aero Brokerage, South Omaha, Nebraska.

SACRIFICE: J6-5 Whirlwind P2A; fine condition; engine 260 hours total; lots instruments. Flying banner; extra J6-5; propeller, starter, etc. Valued $1,500; best cash offer over $1,000 takes it. Ed Taafe, Winter Haven, Florida.

J6-5 FAIRCHILD: Motor just majored and ship completely rebuilt, recovered and repainted. Steel prop, starter, air wheels, tail wheel; $1,500. LeBlond 70 Porterfield: Flown 3 months since new, $1,100 Warner Cessna: 4-place cabin, good condition, steel prop, air wheels, bargain at $750. New and used airplane parts for sale. Pioneer Aircraft Co., Teterboro Airport, Hasbrouck Heights, New Jersey. Phone: H. H. 8-0747.

ENGINES

Gipsy, LeBlond, Kinner, Wright, P. & W.

GIPSY DH: 90 h.p. motor; 4 cylinder in-line, with prop. Nice condition, $350. Also Moth parts. Will sell without down payment. Replaces Cirrus. Aviation Finance Co., Hemlock, N. Y.

LE BLOND 7-D: 90 h.p. 25 hours since factory major; new condition, $300. Heywood starter, $35. Buy ship using same motor. E. M. Ronshausen, St. Clairsville, Ohio.

KINNER K-5: engine in excellent condition complete with magnetos and carburetor. Reasonable for cash. Robinson Air Service, Inc., Municipal Airport, Rochester, N. Y.

WRIGHT J6-7E: Serial No. 13855; no time since top overhaul by Wright station. Cylinders sand blasted, new rings, new rocker arm bearings, new harness, etc. Complete and reasonably priced. Warner 125: 585 hours total, including 10 since major, $425 with reconditioned steel propeller. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

J-5, TOTAL TIME 497 hours since new; standard pistons, new harness. This is a honey. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

WASP B: Total time 550 hours; used Wasp propeller. Turgeon Airways, Lewiston, Maine.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

BROTHER, CAN YOU SPARE A DIME? If you can, send it to me and I'll send you my 1936 Low-Priced Aviation Material Catalog. (Canada 20c). Karl Ort, 625 W. Poplar, York, Pennsylvania.

BALLOON FOR SALE: Balloon 18 ft. diameter round, lifts 125 pounds. Aluminum coated. Safety valve. For advertising, etc. $150. M. Hamza, 308 Thirty-Second St., Union City, New Jersey.

FLEDGLING: Almost complete line of new and used parts. J5 and J6 engine parts. Noveaulux 1000 watt flood lights. Sperry revolving beacon, boundary lights. Curtiss Junior and Travelair 6000 parts. All sizes aircraft bolts and tubing. Aircraft Brokerage Corp., Flushing Airport, Flushing, N. Y.

PARTS FOR Stinson T and U trimotor, Pilgrim and Lockheed Orion. Hamilton Standard propellers, 165 h.p. and up. Scintilla magnetos; Stromberg carburetors; Eclipse starters; miscellaneous engine parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

PORTABLE HANGAR: Prefabricated wood and metal. Set it up yourself in a couple of days. The answer to low cost storage. $9.50 monthly; no down payment. Bennett Air Service, National Distributor, Hightstown, New Jersey.

LANDING LIGHTS: Retractable (Ryan) complete, $30 pair. Non-retractable Pioneer, $18 pair. AG9-D Scintilla shielded mags, $25 each. Pioneer tach, $12. Scintilla switch, $10. Warner carb, overhauled, $12. Wabble pump, hand type $12. 30 x 5 wheels for 1¾ inch axles, with good tires, tubes and brakes, $25 pair. 24 x 4 Bendix wheels, tires, tubes and brakes, $20 pair. Irving seat chutes, $65 and $75. N. B. Rich Company, Boston Municipal Airport, East Boston, Massachusetts.

BRAND NEW PAIR 6.50 x 10 semi-airwheels with brakes, $65. Good used pair tires and tubes for same, $20. Brand new pair 32 x 6 non-skid tires, $17.50 pair. Brand new 15v-15a generators with control boxes, $40 set. Excellent used direct electric (F-141) starters for J-5, Jacobs, Lycoming, etc., $50. Hand inertia for same, $15. Factory reconditioned Hamilton hub for Warner Super Scarab, Kinner B or R-5, etc. (Des. 7056), $40. J-5 hub complete, $15. J-5 magneto, complete, $7.50. Ryan retractable landing lights, complete with bulbs, $25 pair. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

COMPLETE SET 32 x 6 Bendix wheels, brakes: 36 x 8 tires and tubes; spare wheel and tire; good condition, $30. C. Fetters, 2704 S. Wayne Avenue, Fort Wayne, Indiana.

ONLY APPROVED exhaust collector and air intake heater for Continental A-40 series motor. Cub installation. Information and orders furnished by Wooster Aeronautical Corp., P. O. Box 349, Wooster, Ohio.

WACO 10 AND OX parts for sale cheap. Miller overhead, complete, $25. Nearly new prop. spinner, $20. Have almost anything you need for Waco 10. A. J. Cupples, Coast Guard Air Station, St. Petersburg, Florida.

WHEELS: New Ebbert-Hatch semi-air, complete, $70. Available in three sizes. For description and illustration get our catalog. Snyder Aircraft Company, Municipal Airport, Chicago, Illinois.

GENERAL STREAMLINE brake wheels, 27-inch, Timken bearing equipped, complete with tires, tubes, axle stubs and brakes, $100. AERO DIGEST, Box 2391.

CYLINDERS for Continental 210, A-70; Lycoming; J-5; J-6; Kinner C-5; English Gipsy. Crankshafts, master rods, rocker arms, pistons, rods, intake pipes for above. Smith controllable propeller, almost new; best offer takes it. G. D. Kelsey, Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

AERONCA C-2, C-3 parts; also parts for Robins, Waco 10, Great Lakes, others. Complete Aeronca and OX-5 motors; parts. Detailed information furnished on request. Northeast Philadelphia Airport, Inc., 200 East Roosevelt Blvd., Philadelphia, Pa.

PRICED FOR QUICK SALE: Curtiss Robin, modernized J6-5 Wright, $950. Model 15-A Eaglerock parts: wing panels, $40 each; uncovered fuselage, $50; landing gear and wheels, $30; tail group, $40. Kinner K-5 motor, complete with only 300 hours since new, $250. 1935 Taylor Cub E-2, Continental A-40-3 engine; 230 hours since new, $1,000. R. E. Lee, Municipal Airport, Rocky Mount, North Carolina.

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More than 26,000 people read AERO DIGEST every month!

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FORMS FOR THE BIG OCTOBER ISSUE CLOSE SEPTEMBER 18th.

AERIAL ADVERTISING banner: 6′ by 60′, includes release, rope, spreader bars, etc., $57.50. (Special release for Aeronca, $5 extra.) Northeast Philadelphia Airport, 200 East Roosevelt Blvd., Philadelphia, Pennsylvania.

WASP, J-6, J-5, Challenger, Warner, Lambert, LeBlond, OX, steel propellers, $40—$75. Overhauled motors: J-5, OXX-6, 220 h.p. geared Hisso. Starters: electric inertia, Heywood 5 cyl. Instruments. Generators. A-N specification dope, 80¢ gal. Wings Travel Air, American Eagle, Swallow, Robin, Taperwing Waco, Eaglerock. Oleos, vees: Stearman, Command-Aire, others. License your OX Travel Air, Robin, with radial motor. We have installations. Miller Flying Service, Montclair, New Jersey.

BARGAIN, SEPTEMBER only: J-5 latest type rocker box covers, brand new, 20¢ each. J-5, J6-9 and all models Wasps, new majored, export certificates. Parts for all above engines, new and used; lowest prices. Write for lists. Lockheed Air Express, with or without Wasp; cheap. Plane just majored, excellent condition. Eastern Airplane Supply Co., 505 West 54th Street, New York, N. Y.

KINNER K-5 front exhaust engine, just major overhauled; American Cirrus and Hornet parts. New Taylor Chummy parts. Sacrifice for cash. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

ATTENTION: Wasp C parts; Kinner parts, heads; Aeronca parts. 950 x 12 wheels, brakes, tires, tubes and axles. Series 6 electric inertia starters, overhauled. Kinner speed ring: J6-9, 7 speed ring. Pyle National landing light. OX Bird radiator; OX Bird mount. Write for complete listing in catalog. Gallant National Aviation Supply Company, Boston Municipal Airport, Massachusetts, Shobe Airlines Hangar. We buy all types of Parts and Equipment. What do you wish to buy? What have you to sell?

FOR SALE: Complete parts for Waco 9, less engine. Complete Challenger engine, disassembled. New and used Challenger cylinders. Amsterdam Flying Service, Amsterdam, New York.

LYCOMING: Complete. Warner 125 h.p., complete. Goodyear non-brake type wheels, complete with new tires, tubes, 22 x 10 x 4; $45. Monarch Air Service, Municipal Airport, Chicago, Ill.

FOR SALE: Wings for all makes of airplanes. Try our wing exchange. Trade your wrecked wings for licensed rebuilt wings. We have been in the wing-building business since 1919. N. L. Aircraft Co., Vermilion, Ohio.

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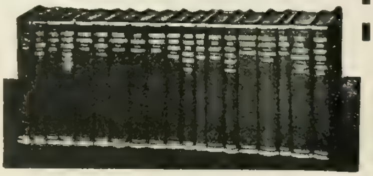

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Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.

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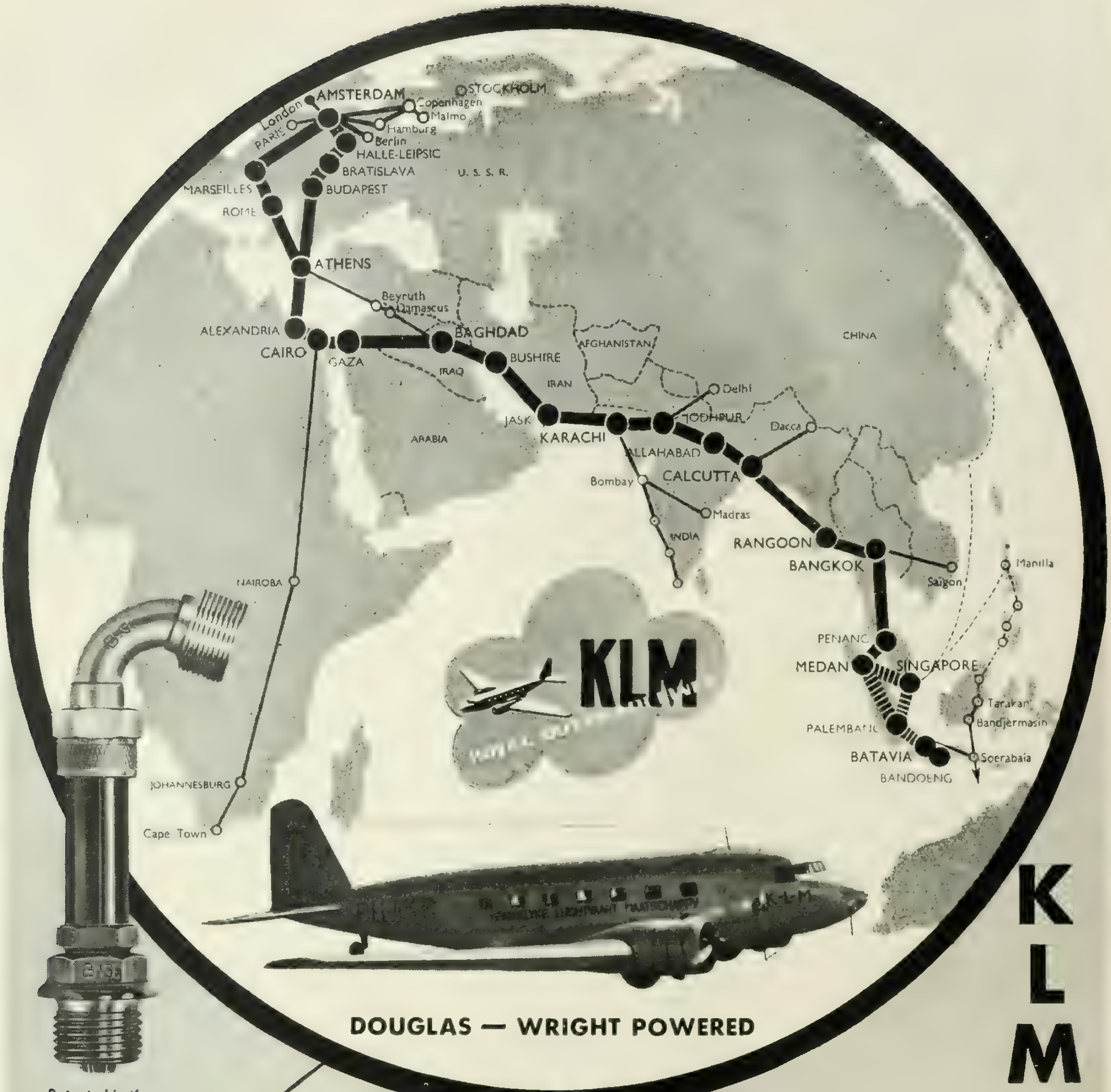

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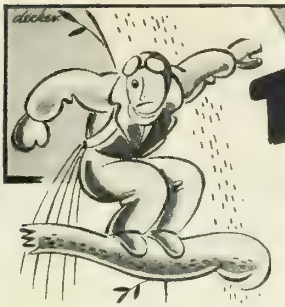

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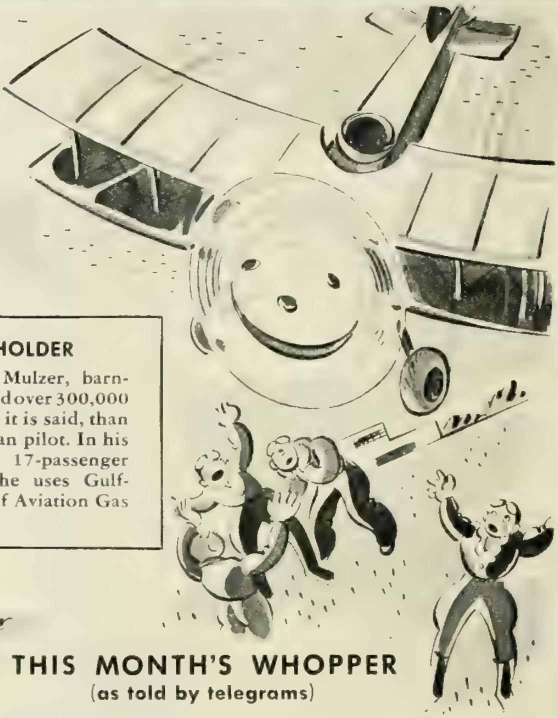

Sometimes your editor wishes that all pilots were old maids. Then he'd always be sure of having bales of gossip for this page. So, please, after you run through this page, swipe a post-office pen and shoot us some news. Direct your letters to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
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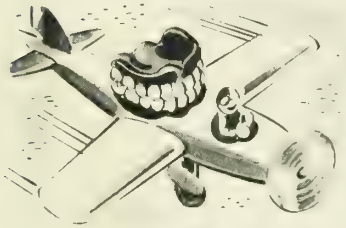
ONE TOOTH? PHOOEY!



" 'W.N's.' story about *one* false tooth being air-expressed from Nassau to Miami is small potatoes. I know of a South Carolina gentleman who had his 9-year-old *upper and lower plates* flown from Spartanburg to Greenville for repairs." —J. B.

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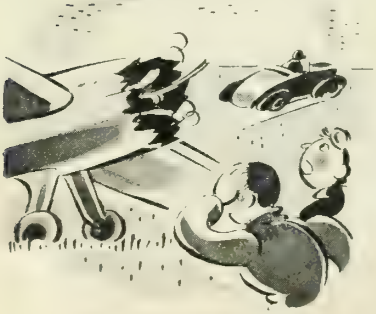

"A lady flier tells me this one about a test pilot.

"While he was up putting a plane through its paces, the motor fell out. But the pilot just lifted his eyebrows, kept his hands on the stick, and landed the plane in front of the hangar.

"As the ground crew stood there open-mouthed, he shrugged his shoulders, climbed in his car and motored away, not saying one blame word.

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(as told by telegrams)

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ART. YE GODS! DIDN'T THINK THAT OLD CRATE COULD GET OFF THE GROUND. SID.

SID. POLICE PLANE AT MORRISTOWN, N.J., REPORTS JENNY FLYING UPSIDE DOWN WITHOUT A PILOT. CLAIM THEY DISTINCTLY HEARD HER YELLING "WHOOPEE." NO ONE CAN CATCH HER. WILL YOU HELP? ART.

ART. WILL HAVE YOU IN JAIL FOR THIS. YOUR JENNY NOW OVER THIS AIRPORT LOOPING LIKE MAD AND WON'T STOP. CLAIMS SHE'S AN EAGLE. WHAT DID YOU DO TO HER? SID.

SID. DIDN'T DO ANYTHING EXCEPT GIVE HER A FILLING OF GULF AVIATION GAS. ART.

ART. THAT'S ENOUGH. TRAILED JENNY TO PHILADELPHIA. SHE CHASED COWS AND DID BARREL ROLLS ALL THE WAY. SAYS SHE WON'T COME BACK TO YOU UNLESS YOU PROMISE TO FEED HER GULF AVIATION GAS ALWAYS. MAKES HER FEEL LIKE A SPRING CHICKEN. SID.

SID. TELL JENNY I PROMISE. ART.

ART. O.K. BUT I WANT IT IN WRITING. JENNY.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF

GULF AVIATION PRODUCTS

This new bi-motor with retractable landing gear, wing flaps, two-way radio installation, and complete blind flight equipment, is to be delivered to Parks Air College. It will be placed on the "line" for the use of advanced professional flight students. Of the type now accepted as standard for land planes on air transport lines throughout the World, this bi-motor, the "Monocoach", gives the Parks professional flight student the advantage of thoroughly modern flight equipment.

"GO TO PARKS" is Aviation's Advice to YOU—

You want to enter aviation. The type of training you secure will have an important bearing upon your career in this great industry that "in a few years has revolutionized the habits of the world". It can mean all the difference between just a job and the glorious achievement you desire.

You will do well to select a school which has earned the favorable recognition of the entire industry. Then, when you graduate, the prestige of the school will be yours, too. Here are a few facts that will help you in your consideration of Parks Air College.

A correspondent,* in making his application for admission to Parks Air College, wrote:

> "Both my friend and I contemplated attending another school, but, as you know, I first investigated Parks, and the result is, both of us are on our way there."

Then he added this significant statement:

> "I made a trip to Miami yesterday to talk to the Pan American and Eastern Airlines people, and their advice was, 'Go to Parks'."

ONLY PARKS GRADUATES WANTED

So many Parks graduates are found at the principal maintenance base of another major airline* that a visitor remarked: "It looks here like a reunion of Parks graduates". An order, effective throughout the extensive system of this airline, directs that all new personnel for the maintenance division shall be selected from among Parks graduates if any are available. Since Parks Air College is independant, being unrelated financially to any other organization, such an order can result only from recognition of the superior merit of Parks training and Parks graduates.

PARKS PROFESSIONAL FLIGHT GRADUATE RECEIVES COPILOT APPOINTMENT

This wire from J. D. MacGregor, Operations Manager of Pan American Grace Airways, requires no comment except to say that Mr. MacGregor follows a rigid policy of selecting only the highest type of new flight personnel:

> "YOUR WIRE JUNE SEVENTEENTH HAVE OPENING FOR COPILOT SUGGEST FRANK WHITTAKER (not his name*) COME HERE OUR EXPENSE IMMEDIATELY FOR INTERVIEW AND BE PREPARED DEPART FOR SOUTH AMERICA FRIDAY IF HIS APPLICATION ACCEPTED."

Two days later Whittaker, an executive Transport Pilot graduate of Parks Air College, wired:

> "SAILING FRIDAY FOR CRISTOBAL FLYING FROM THERE TO LIMA."

(This was the second Executive Transport Pilot graduate Mr. MacGregor secured from Parks this year for a position as copilot.)

THE TRAINING DIVISION OF COMMERCIAL AVIATION

Instances could be multiplied showing that Parks Air College is recognized by both aircraft manufacturers and airline operators as the "training division of commercial aviation". Parks graduates are with every major airline and aircraft factory in the United States. They are serving as chief pilots, pilots, copilots, flight engineers, meterologists, in maintenance, radio, sales, field operations, and the various branches of production, including aircraft factory production manager.

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If you want to enter aviation, if you are genuinely in earnest in your desire to make a career for yourself in this new industry, if you are willing and anxious to devote all of your energy to your preparation, then Parks Air College will welcome you.

You are invited to send for the catalog. It gives complete information about facilities and courses.

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Winter Term, January 4.

*Name on request

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62's LOG

NEW YORK TO LOS ANGELES

2600 Miles in 14 hours, 54 minutes, 46 seconds.

NORMAL CRUISING SPEED

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CERTIFIED FUEL CONSUMED

318 Gallons Average: *More than 8 M. P. Gal.*

As Louise Thaden and Blanche Noyes stepped out of their winning Beechcraft in Los Angeles they were besieged with questions—and here is the gist of their replies:
How do we feel? Just fine! Hard trip? No. We merely cruised our engine. How are we going back to New York? In a Beechcraft, we hope. That's the easy way to travel—and so easy to fly!

Stock Model (C17R) BEECHCRAFT *Wins Bendix Trophy*

Mr. Vincent Bendix congratulating Louise Thaden {Left} and Blanche Noyes on their winning flight.

The fact that entry number "62" won the Bendix Trophy is only *part* of the story. This flight established a new women's record from east to west; and it is the first time in history a woman won the Bendix Trophy. BUT the sensational angle to the story is that "62" is a stock model Beechcraft, *without* special racing equipment. *The Beechcraft was held down to its normal cruising speed,* and the two ladies stepped out in Los Angeles feeling as if they had made a *pleasure trip* rather than having won the most hotly contested speed and distance event in America.

THE BEECH AIRCRAFT CO.
WICHITA, KANSAS, U.S.A.

At the 1936 National Air Races in Los Angeles

79.66% OF ALL WINNERS USED KENDALL OIL!

The Kendall Refining Company takes this opportunity to congratulate the following winners who used Kendall Oil at the National Air Races, and to thank them for choosing Kendall Oil as the lubricant they believed best fitted to carry them to victory in these grueling tests.

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Jeannette Lempke
Harry Crosby
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Edna M. Gardner
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Frank Spreckels
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John R. Todd
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Jerry Fairbanks
Steven Hawes
Helen McCloskey

AGAIN KENDALL LEADS ALL OTHER OILS at the National Air Races! Forty-seven out of a possible fifty-nine winning planes were lubricated with Kendall Oil. This is the eighth successive year in which Kendall Oil has overwhelmingly led the field against the combined showing of all other oils. Could there be better proof of Kendall's superiority?

KENDALL REFINING COMPANY · BRADFORD, PA.

RYAN *Training wins again!*

Frank Spreckles who made full use of his complete Ryan training to win this year's Ruth Chatterton Derby.

Ryan training facilities are the finest. All students train in high-performance Ryan S-T planes.

FRANK SPRECKLES WINS RUTH CHATTERTON DERBY

Based exclusively on the ability and knowledge of the pilot, the 1936 Ruth Chatterton Derby from Cleveland to the National Air Races at Los Angeles this year was won by Frank Spreckles, a graduate of the Ryan School of Aeronautics.

Frank Spreckles, when the test came, had the expert piloting, navigating and all around airmanship ability necessary to win the great National Classic, against a field of 37 which included many veteran pilots.

Ryan's successful training policies are based on seventeen years of continuous operation dedicated to producing thoroughly trained men. It is this same outstanding RYAN training that started Peter Dana on his record-breaking career with his West-East transcontinental record, and a tri-flag mark from Canada to Mexico; Bill Coyle —TWA's veteran Western-division Chief Pilot; Jerry Jones, famous Pan American Alaskan pilot, and a host of other outstanding pilots in this great industry.

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Betty Browning and the 1936 Cessna, Model C34, which won the Amelia Earhart Trophy Race at the 1936 National Air Races. The Cessna's speed, in this sole ATC event of the Races this year, over five laps of a five mile closed course was 156.4 mph.

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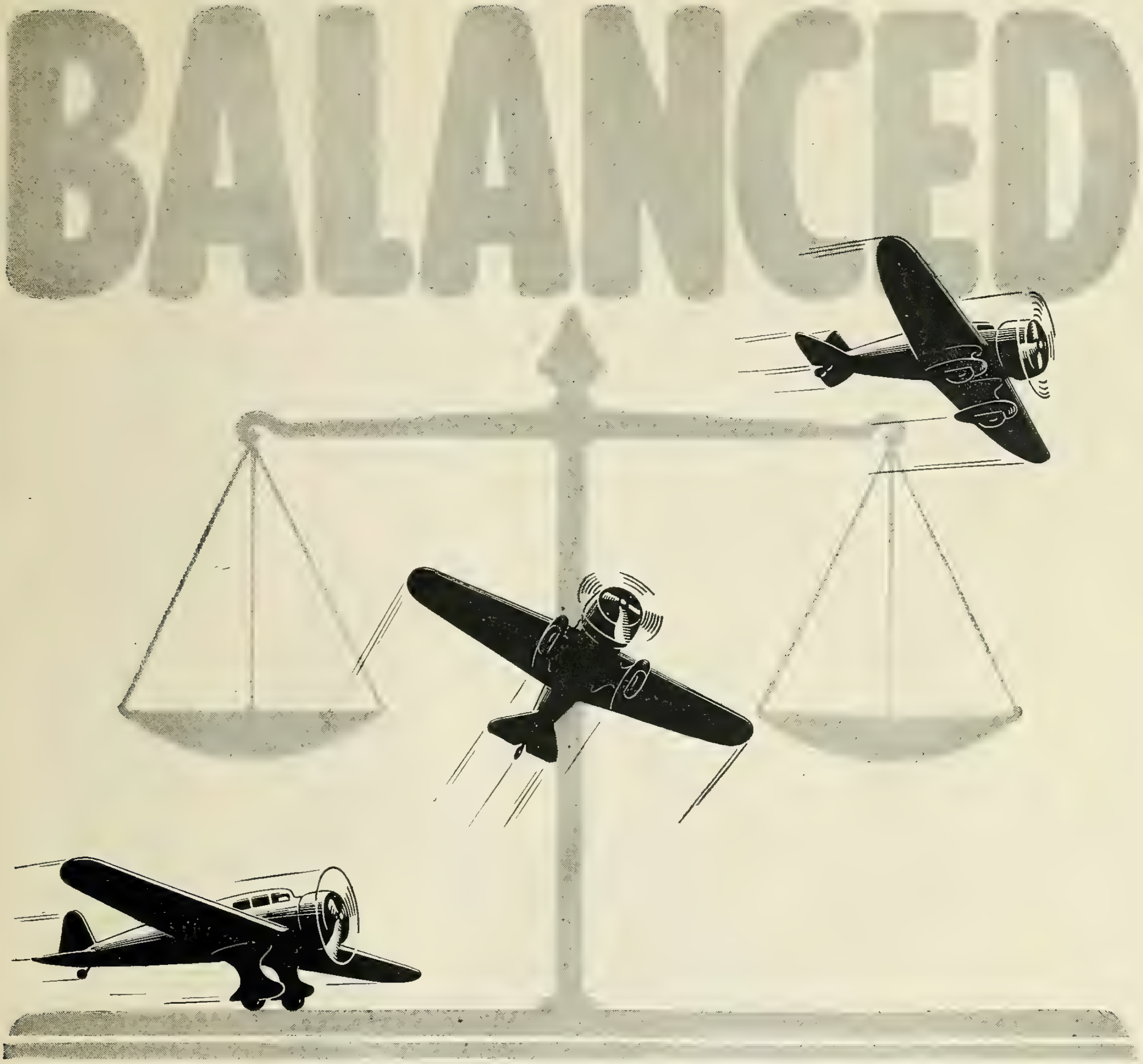
WICHITA, KANSAS, U.S.A.



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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone PLaza 3-6989. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5. Copyright 1936 by Aeronautical Digest Publishing Corporation.

CHICAGO: L. F. McClure, 919 No. Michigan Ave., Ph. Superior 1086.
LOS ANGELES: James C. Galloway, 1129 Mohawk St., Ph. Fitzroy 6332.
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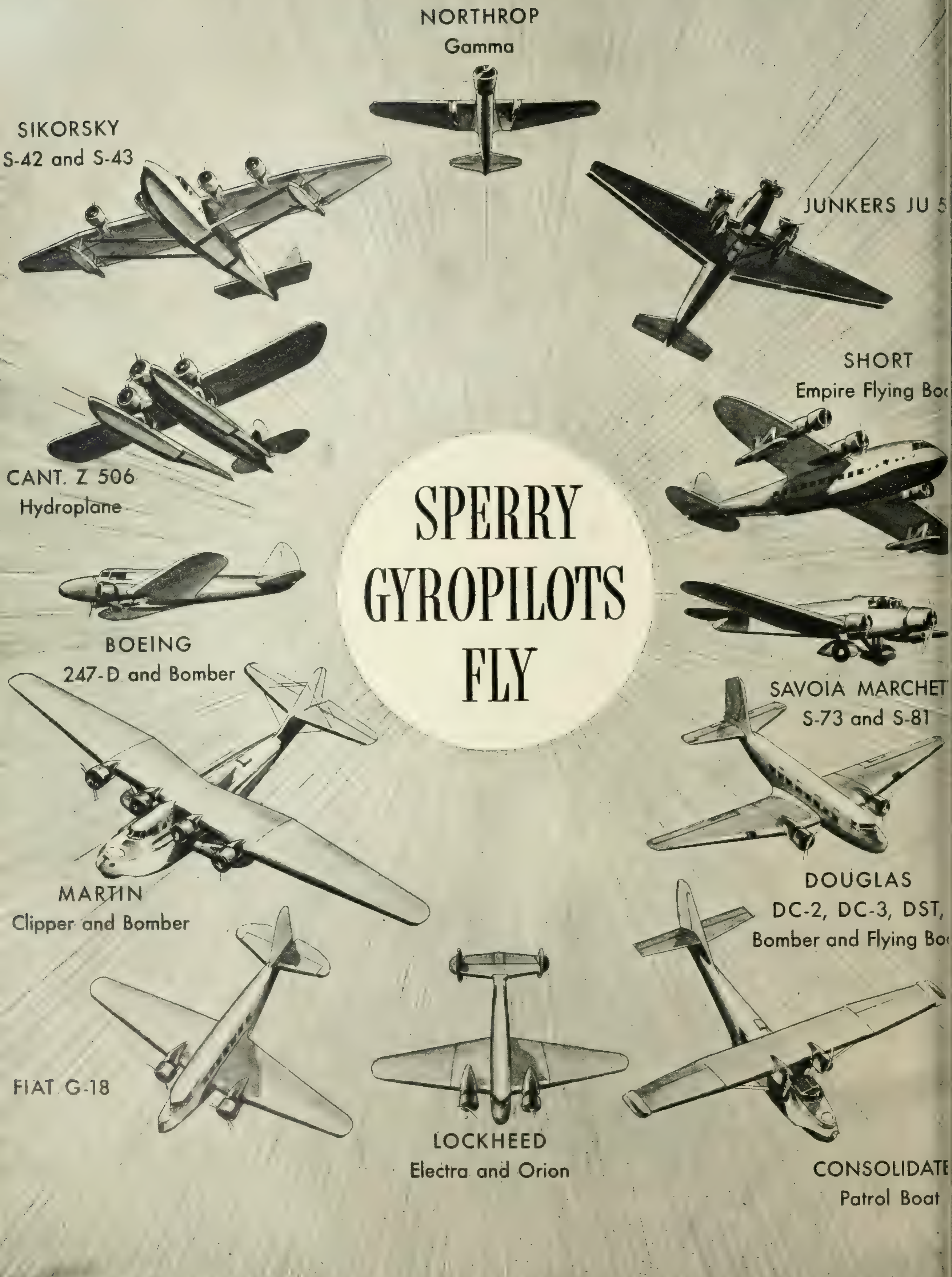
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AND----

Roosevelt and Farley Charged "Fraud and Collusion"!!

FRANK A. TICHENOR

Roosevelt's "Forgotten Man"—12 of them—DEAD—the air mail pilots

● Through a maze of intrigue, patterned first to conceal and later to confuse, at last we find the amazing facts behind the air mail contract cancellations, and their relation to the clandestine financial and political schemes of one of President Roosevelt's sons!

Elliott Roosevelt made a contract with Anthony H. G. Fokker to sell military airplanes to Russia, detouring around the American embargo by camouflaging the planes as commercial types. He wrote a letter setting forth the terms of this contract which verbally he represented as having the approval of his father, and received $5000 in cash as a binder. And under a "gentleman's agreement" incident to the written contract, he entered into a plan to reorganize the country's airlines into a national monopoly. Was the President a party to this transaction? We know that at least for six weeks—from February 2, 1934 to March 17, 1934—the efforts of Elliott and his associates dovetailed so closely with Administration actions that even cancellation of air mail contracts on February 9, 1934, seems to have been aimed at furthering this scheme.

Then, when "politics" destroyed his plans, he made desperate efforts to have his Fokker contract re-written substituting another in his place, and finally, according to a Deputy Commissioner of Internal Revenue, for income tax purposes denied having received any part of the $5000. Unsuccessful efforts were made to have Fokker amend his own income tax return to substantiate this contention.

The Nye committee seized Fokker's complete file and one who functioned as Elliott Roosevelt's agent solicited Herbert A. Reed, Fokker associate, to change his testimony if called before the Nye committee, it is alleged.

Unlike the lives of the army aviators sacrificed in 1934 by the New Deal's gambling with the air mail, truth, crushed to earth, may rise again. In rising, after thirty months, it reveals to us that while President Roosevelt was driving the airline operators from the skies, his son was dickering to make a fortune as the silent partner in the promotion of a corporation designed to consolidate and swallow all the airline companies the moment Jobmaster Jim Farley cancelled their contracts. Previously to those tragic weeks when twelve army aviators were being needlessly sacrificed, young Roosevelt already had another iron in the aviation fire; he was a high-paid, if low pressure, salesman for Fokker attempting to peddle to Soviet Russia American-built aircraft so designed as to be quickly convertible for military purposes. Fokker is the Dutch designer who manufactured Germany's fighting airplanes during the World War. Father had only recently recognized Soviet Russia. The New Deal, among its myriad blueprints for business, had a plan for a corporation to finance the purchase which Stalin's agents were to make in this country. The prospects for a salesman with the name of Roosevelt seemed rosy indeed.

The young man dangled the Russian bait at the very time the Black Committee was investigating air mail contracts. Before those contracts were cancelled by Farley with a blast of virtuous venom against "fraud and collusion," Elliott had pocketed $5000 of Fokker's money, and Basil O'Connor—Father's law partner in New York—was hearing about the program for a new corporation to absorb the wicked collusionists, and earn $15,000,000 a year out of airmail, plus whatever passenger and express traffic brought in. That plan of Elliott's and Fokker's did look wonderful. So wonderful that Elliott and his associates were able to disclose the administration policies to Farley's victims weeks before the President informed the Congressional committees engaged in writing air mail legislation!

Somewhere along the line—in those weeks when the army was carrying the mails and Congress was contemplatin New Deal laws that would purify the sinfulness of the private operators—Elliott confessed to a fellow-promoter that the wicked thing called politics had poked its nose into the whole affair so deeply that the dream for a Consolidation of Consolidations would have to be slept on a while longer before it could come true.

As head of the Consolidation of Consolidations for carrying the mails he had urged the appointment of Father's Coordinator of Coordinators, Frank Walker.

Though the big dream had to be shoved aside, there still remained the smaller dream of selling airplanes to the Russians.

Aviation, however crimson its crime in the eyes of Farley, had other comforting virtues for Elliott. One of these was a comfy berth with the Aeronautical Chamber of Commerce, into which the President's son bedded down two days before the New Deal permitted private lines to resume transport of the mails under new contracts. Annullment of the old contracts, incidentally, has already cost the taxpayer $3,767,355 in settlements the Roosevelt administration made with some of the injured contractors, while other suits for many millions remain unsettled.

For seventeen months Elliott hung onto the title of vice-president of the Aeronautical Chamber of Commerce. Nor was he the only New Dealer who, with Father's and Farley's apparent approval accepted salaries from the industry that had been so *sinful.* O. Max Gardner, released as Democratic Governor of North Carolina in 1933, became counsel to the Aeronautical Chamber of Commerce, at $75,000 a year, as of March 15, 1934—at which time the mails were being carried by army planes. Mr. Gardner held the handsome post with the "crooked" aviation industry for a year.

In August, 1933, the sixth month of the New Deal, Elliott Roosevelt blossomed forth in the newspapers as an aviation editor. His journalistic background having consisted of a brief stint with an advertising agency and a few weeks, during prohibition, with an airline that shuttled the thirsty between Los Angeles and Agua Caliente, the news syndicate obligingly provided him with a ghost writer and a healthy pay check. Someone also supplied the young man with a business agent, one Grenville W. Stratton, whose career is supposed to have included a turn in the Secret Service.

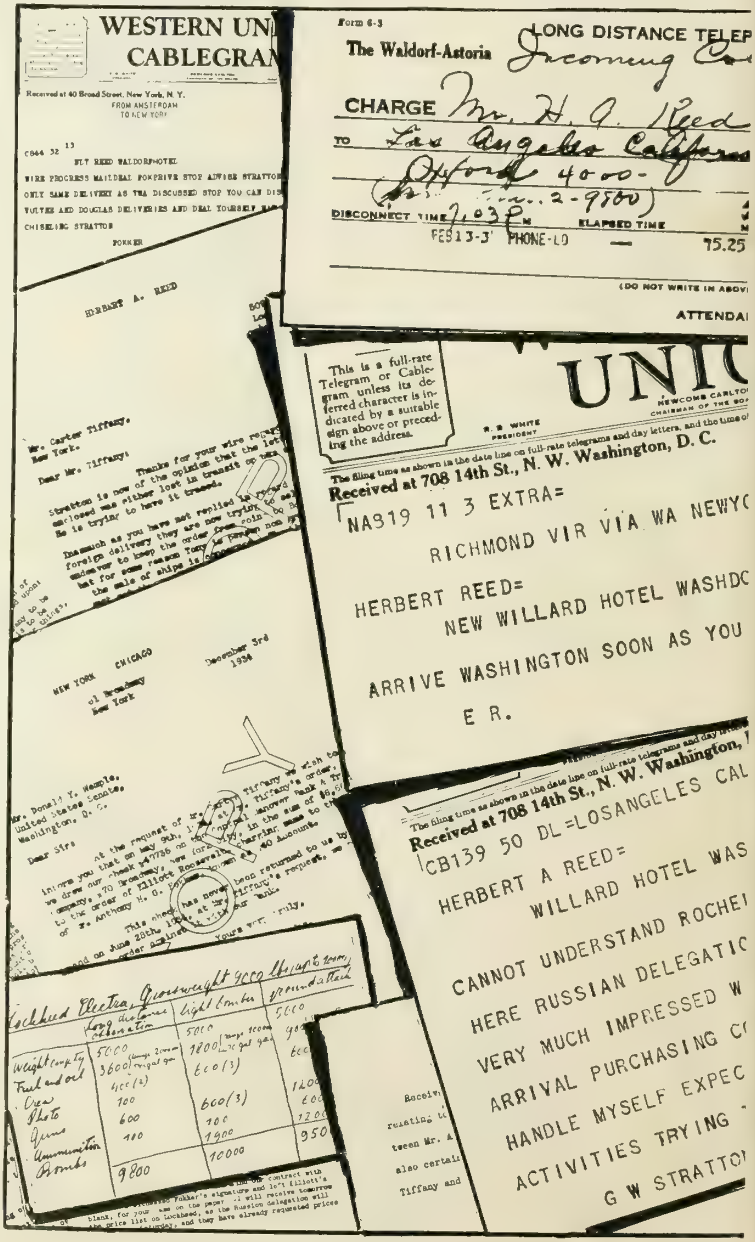
They slip into our story on January 15, 1934, the day Tony Fokker signed a licensing contract with Donald Douglas for all Europe except Soviet Russia. Douglas suggested that Fokker employ young Roosevelt as a salesman. Except for a name to conjure with, Fokker wondered what qualifications the chap could have for the job. Receiving Stratton and Roosevelt in his apartment the next day, the Dutch manufacturer asked the President's son to let him have a memorandum outlining what he deemed he could do as an airplane salesman in Europe.

In three days Stratton was back again with the outline of a contract which would obligate Fokker to pay Elliott a nice salary but neither on nor between the lines seemed to obligate Elliott to do anything specific in the way of salesmanship. After all, Stratton announced, Elliott couldn't sign any contract without first submitting it for his father's approval.

Elliott's real duties, he suggested, would best be expressed by a gentleman's agreement. As one gentleman to another his services would be available "in any matters, either foreign or domestic, governmental or otherwise which affected the business interests or welfare of F." (Fokker).

That sounded all right to Tony Fokker. On such an understanding he was willing to sign any contract of employment young Roosevelt could get approved. Elliott asked for $25,000 a year. There was much talk of the prospective market in Soviet Russia. Hadn't the Roosevelt-Litvinoff kissing of hands presaged a trade that was to run into the hundreds of millions? Wasn't a Russian delegation of engineers already on the way to have a look at American aircraft? Wasn't the New Deal forming a federal corporation to finance Russo-American trade? The forecast was "visibility unlimited."

With Fokker's proposal in his pocket and Douglas at his side Elliott flew out of Los Angeles for Washington on the afternoon of January 24. Meanwhile



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DISCONNECT TIME 7.03 P M ELAPSED TIME
FEB13-3' PHONE-LD — 75.25
(DO NOT WRITE IN ABOV
ATTENDA

HERBERT A. REED

Mr. Carter Tiffany,
New York.

Dear Mr. Tiffany:

Thanks for your wire re
Stratton is now of the opinion that the let
enclosed was either lost in transit or
He is trying to have it traced.

Inasmuch as you have not replied in regard
foreign delivery they are now trying to
endeavor to keep the order from going
but for some reason Tony is
the sale of ships is

NEW YORK CHICAGO

December 3rd
1934

.. Broadway
New York

Mr. Donald Y. Wemple,
United States Senate,
Washington, D. C.

Dear Sir:

At the request of Mr. Carter Tiffany we wish to
inform you that on May 9th, 19 at Mr. Tiffany's order,
we drew our check #47736 on the Central Hanover Bank & Tr
Company, 70 Broadway, New York City, in the sum of $8,6
to the order of Elliott Roosevelt, bearing same to th
of Mr. Anthony H. G. Fokker, known as 40 Account.

This check has never been returned to us by
and on June 28th, 1934, at Mr. Tiffany's request, we
order against it with our bank.

Yours very truly,

Lockheed Electra Grossweight 9000 lbs (up to 10000)

	Long distance observation	light bomber	ground attack
Weight empty	5000	5000	5000
Fuel and oil	3600 (range 2000 m [illegible] gal gas)	1800 (range 1000 m 270 gal gas)	90
Crew	400 (2)	600 (3)	60
Photo	100		
Guns	600	600 (3)	120
Ammunition	100	100	60
Bombs		1900	120
	9800	10000	950

and our contract with
witnessed Fokker's signature and le't Elliott's
l will receive tomorrow
blank, for your same on the paper
the price list on Lockheed, as the Russian delegation will
Saturday, and they have already requested prices

Receiv
relating to
tween Mr. A
also certai
Tiffany and

This is a full-rate Telegram or Cablegram unless its deferred character is indicated by a suitable sign above or preceding the address.

UNI
NEWCOMB CARLTO
CHAIRMAN OF THE BOA
R. B. WHITE
PRESIDENT

The filing time as shown in the date line on full-rate telegrams and day letters, and the time o
Received at 708 14th St., N. W. Washington, D. C.

NA819 11 3 EXTRA=
RICHMOND VIR VIA WA NEWY
HERBERT REED=
NEW WILLARD HOTEL WASHDC
ARRIVE WASHINGTON SOON AS YOU
E R.

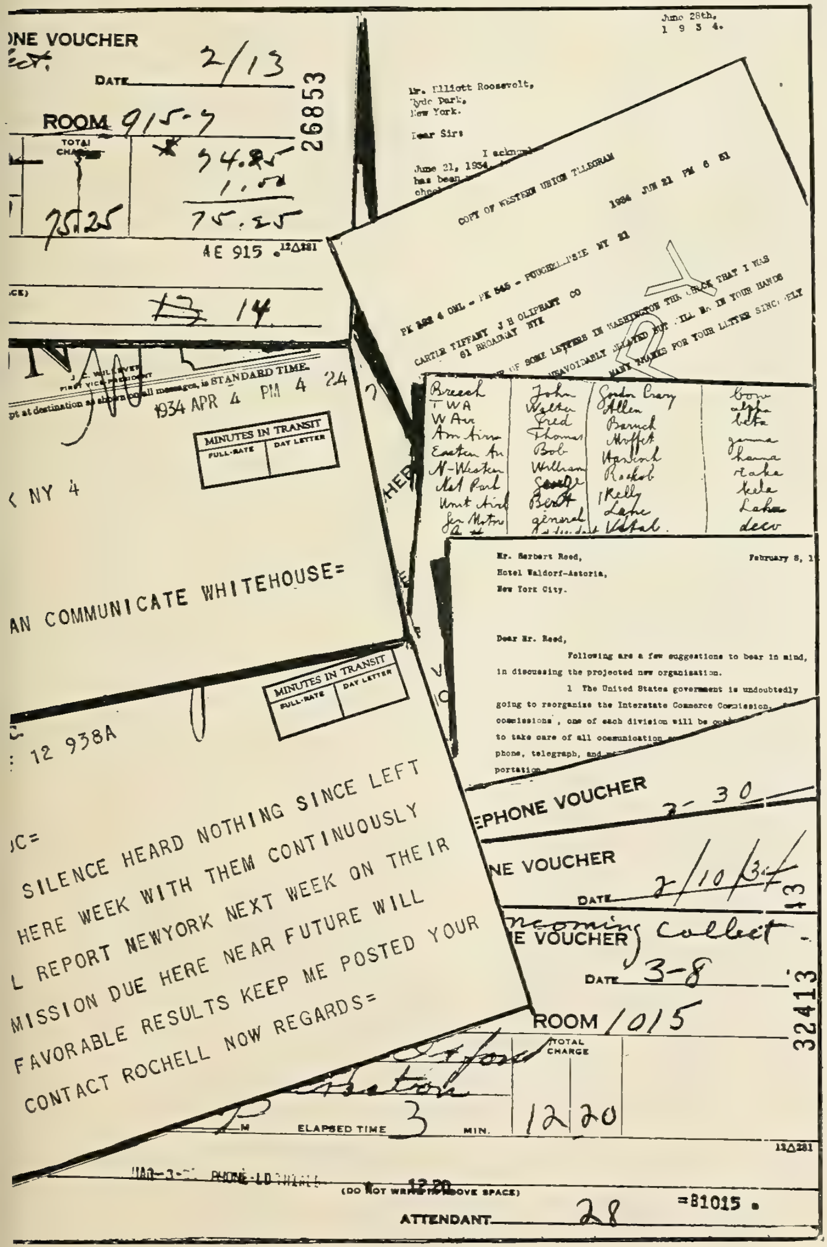
The filing time as shown in the date line on full-rate telegrams and day lette
Received at 708 14th St., N. W. Washington,

CB139 50 DL =LOSANGELES CAL
HERBERT A REED=
WILLARD HOTEL WAS
CANNOT UNDERSTAND ROCHE
HERE RUSSIAN DELEGATI
VERY MUCH IMPRESSED W
ARRIVAL PURCHASING C
HANDLE MYSELF EXPEC
ACTIVITIES TRYING
G W STRATTO

A few of the hundred-odd documents relating to

Fokker had obtained a licensing contract for Lockheed aircraft in all of Europe, except Soviet Russia.

The next night, January 25, Douglas and Elliott dined and dreamed at the White House. It is a date to remember, for when in March the Black committee probed the list of trades in aircraft stocks to prove there had been no leak on cancellation, it fixed the morning of January 26 as the earliest anyone could have got into the market with such preknowledge. In that fifteen-day interval Fokker was in and out of the market. He sold 6500 shares of Douglas and 3000 United and bought 2900 United.



ONE VOUCHER
DATE 2/13
ROOM 915-7
26853
TOTAL CHARGE
54.25
1.00
75.25
75.25
AE 915
13 14

STANDARD TIME
1934 APR 4 PM 4 24
MINUTES IN TRANSIT
FULL-RATE
DAY LETTER
NY 4
AN COMMUNICATE WHITEHOUSE=

June 28th,
1 9 3 4.

Mr. Elliott Roosevelt,
Hyde Park,
New York.

Dear Sir:

I ackn
June 21, 1934,
has been
check

COPY OF WESTERN UNION TELEGRAM
1934 JUN 21 PM 6 51
PK 283 4 CML - PK 545 - POUGHKEEPSIE NY 21
CARTIER TIFFANY J H OLIPHANT CO
61 BROADWAY NYK
OF SOME LETTERS IN WASHINGTON THE CHECK THAT I WAS
UNAVOIDABLY DELAYED BUT WILL BE IN YOUR HANDS
MANY THANKS FOR YOUR LETTER SINCERELY

Breech
TWA
W Air
Am Airw
Eastern Air
N-Western
Nat Park
Unit Aircr
Gen Motors

John
Walter
Fred
Thomas
Bob
William
Bert
general

Gordon Crary
Allen
Baruch
Moffet
Hancock
Rockob
Kelly
Lane
Vital.

bow
alpha
beta
gamma
hama
raka
keta
Laka
deco

Mr. Herbert Reed,
Hotel Waldorf-Astoria,
New York City.

February 8, 1

Dear Mr. Reed,

Following are a few suggestions to bear in mind, in discussing the projected new organization.

1 The United States government is undoubtedly going to reorganize the Interstate Commerce Commission. commissions , one of each division will be to take care of all communication phone, telegraph, and portation

MINUTES IN TRANSIT
FULL-RATE
DAY LETTER
12 938A
SILENCE HEARD NOTHING SINCE LEFT
HERE WEEK WITH THEM CONTINUOUSLY
L REPORT NEWYORK NEXT WEEK ON THEIR
MISSION DUE HERE NEAR FUTURE WILL
FAVORABLE RESULTS KEEP ME POSTED YOUR
CONTACT ROCHELL NOW REGARDS=

PHONE VOUCHER 2-30

NE VOUCHER
DATE 2/10/34
13

Incoming Collect
E VOUCHER
DATE 3-8
ROOM 1015
32413
TOTAL CHARGE
Stratton
ELAPSED TIME 3 MIN.
12 20
(DO NOT WRITE ABOVE SPACE)
12.20
ATTENDANT 28
=81015

the Reed-Roosevelt-Fokker-Stratton deals

Elliott was a busy boy himself during that period. His agent, Stratton, kept Fokker's agent, Herbert A. Reed, informed of the young man's activities in the East. Reed was formerly Secretary-Treasurer of Fokker Aircraft Corp. and its successor, General Aviation Mfg. Co. On January 25, Stratton reported that Elliott and Douglas had had conversations both at the State Department and with the Russian Ambassador regarding the sale of planes. The next day he brought tidings that Elliott and Douglas had called on Rogendorf, head of the Soviet trading agency (Amtorg) in New York. The same night Douglas and Roosevelt flew back to Los Angeles. Calling at Elliott's home in Beverly Hills, Reed got an earful of cheer.

Elliott said he was confident he could get an order for fifty Lockheed Electras, the purchase to be financed through the new corporation the government was to set up. He suggested that his contract be made with Reed rather than directly with Fokker, saying "Father objects to my entering the employ of an alien, but if the contract is drawn in your (Reed's) name, it will be all right."

One other difficulty threatened that "visibility unlimited." The Russians were primarily interested, Elliott reported, in the purchase of military aircraft, and there might be snags in going after Washington's sanction to finance such sales. He explained, however, there would be no trouble if the planes sold to the U.S.S.R. were ostensibly for commercial use, the structural changes necessary for quick conversion into fighting craft being cleverly covered.

He had another morsel of news. During his stay at the White House "Father said if he were a young man he knew where he would go to make some money." He would, it seemed, go to South America, because there was a possibility that the Pan Americans' air mail contracts would be cancelled, and if someone were smart enough to go down there and line up inter-country contracts he would, if cancellation came, be in line to get the United States Post Office contract.

Young Roosevelt spilled more news of the administration's intentions when he and Stratton met Reed to discuss Elliott's employment contract on January 31 and February 1. He said the administration was anxious to oust those who were then operating the air mail, that it would cancel every contract if such action seemed necessary to effect its purpose, but that the President first wanted a substitute plan that would conserve the equities of the innocent stockholders in the airlines. They were, of course, voters as well as stockholders.

The alert Mr. Reed submitted to Stratton the next day a plan for merging the three major companies into a national monopoly. It proposed carrying long-distance first-class mail by air, thus assuring capacity loads that would reduce rates and wipe out, he estimated, both the airline and the Post Office deficits.

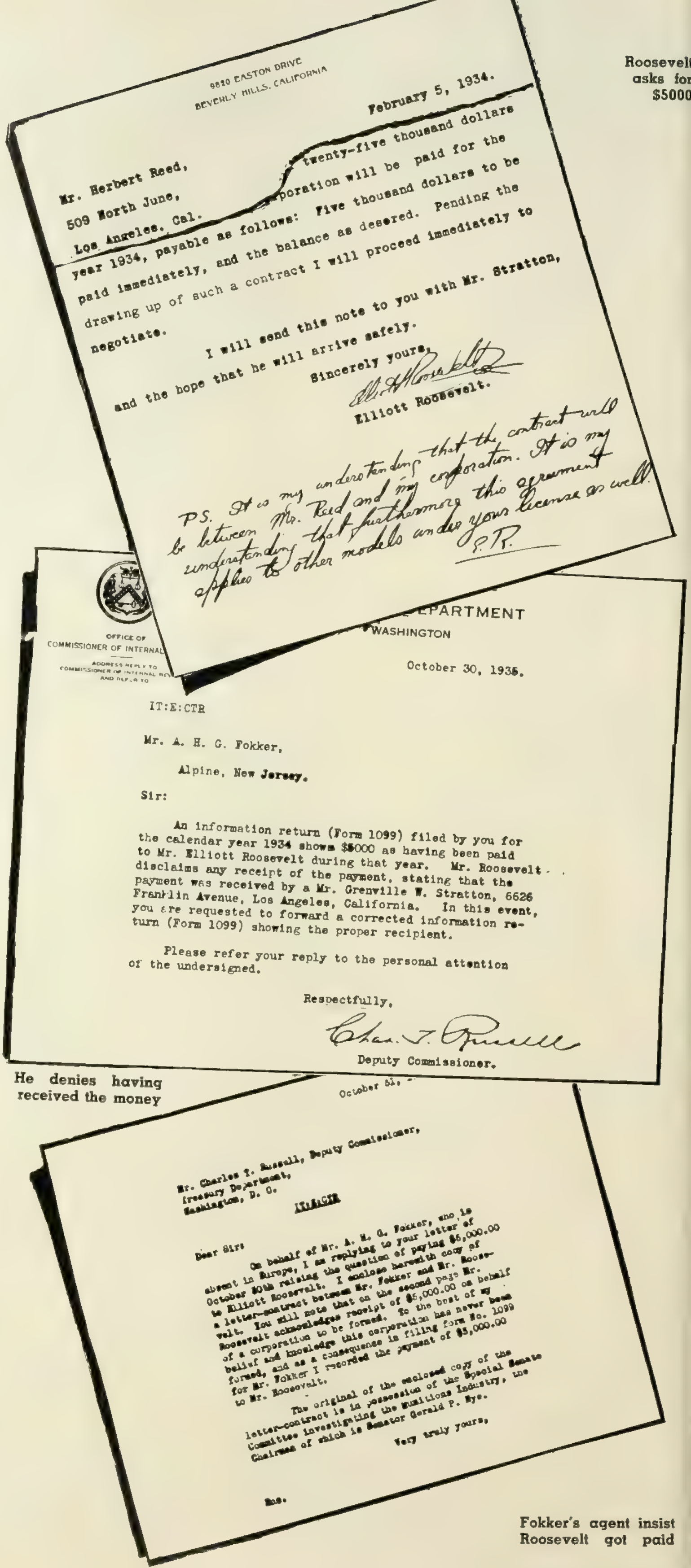
"That's a wonderful idea; it's just what the President wants!" Stratton exclaimed. And then another idea popped out: "It's a wonderful opportunity for all of us to make a lot of money." Would Reed wait while he went to Elliott's house? Reed would—and for four hours did. On his return Stratton said: "Elliott telephoned Washington. The President wants you to do this job. They are wild about your plan."

Reed suggested that the leadership in this New Deal for aviation ought to be assumed by someone whose name was nationally known. Besides he didn't have the money to undertake the enterprise. Stratton remarked that Fokker had enough, or knew where to get it. Both he and Elliott repeated that the administration would cancel existing contracts if necessary to compel the three major lines to accept consolidation.

Reed carried the story to Fokker, to whose skeptical mind it seemed too good to be true. But he had Reed sound out some underwriters and ask Elliott for some proof of the administration's intention to back the plan. The next day, February 4, Washington dispatches said the White House threatened to cancel domestic air mail contracts if the Black Committee investigation evoked proof of "fraud and collusion." Fokker accepted this as evidence of the President's support.

On February 5, Stratton, on Elliott's behalf, asked Reed for a $5000 binder on his employment contract, before proceeding with the airline consolidation. Before forking up the cash Reed said he and Fokker should have a letter from Elliott setting forth his understanding of what the contract should provide. Later that day he received the following letter:

> 9820 Easton Drive
> Beverly Hills, California
> February 5, 1934.
>
> Mr. Herbert Reed,
> 509 North June,
> Los Angeles, Cal.
> My dear Mr. Reed:
>
> Following my conversation with Mr. Stratton the agreement to be formed between your selling organization for Lockheed Electra transport planes and a corporation to be formed by myself for the purpose of aiding in the sale of these planes to the Soviet Union is entirely agreeable to me.
>
> The terms of this agreement, as I understand them, are that this corporation will receive from your organization fifteen per cent of the net selling price of each ship, or parts thereto, or any other items pertaining thereto, for delivery to the Soviet Union. In addition it is further understood that my corporation will in no way participate in the sale of the license in so far as commission is concerned, but will at all times further the sale thereof. It is my understanding that a retainer fee of twenty-five thousand dollars for the services of this corporation will be paid for the year 1934, payable as follows: Five thousand dollars to be paid immediately, and the balance as desired. Pending the drawing up of such a contract I will proceed immediately to negotiate.
>
> I will send this note to you with Mr. Stratton, and the hope that he will arrive safely.
>
> Sincerely yours
> Elliott Roosevelt
>
> P. S. It is my understanding that the contract will be between Mr. Reed and my corporation. It is my understanding that furthermore this agreement applies to other models under your license as well.
> E. R.



Roosevelt asks for $5000

9820 EASTON DRIVE
BEVERLY HILLS, CALIFORNIA

February 5, 1934.

Mr. Herbert Reed,
509 North June,
Los Angeles, Cal.

twenty-five thousand dollars
poration will be paid for the
year 1934, payable as follows: Five thousand dollars to be paid immediately, and the balance as desered. Pending the drawing up of such a contract I will proceed immediately to negotiate.

I will send this note to you with Mr. Stratton, and the hope that he will arrive safely.

Sincerely yours,
Elliott Roosevelt.

P.S. It is my understanding that the contract will be between Mr. Reed and my corporation. It is my understanding that furthermore this agreement applies to other models under your license as well.
E.R.

EPARTMENT
WASHINGTON

OFFICE OF
COMMISSIONER OF INTERNAL

ADDRESS REPLY TO
COMMISSIONER OF INTERNAL RE
AND REFER TO

October 30, 1935.

IT:E:CTR

Mr. A. H. G. Fokker,
Alpine, New Jersey.

Sir:

An information return (Form 1099) filed by you for the calendar year 1934 shows $5000 as having been paid to Mr. Elliott Roosevelt during that year. Mr. Roosevelt disclaims any receipt of the payment, stating that the payment was received by a Mr. Grenville W. Stratton, 6626 Franklin Avenue, Los Angeles, California. In this event, you are requested to forward a corrected information return (Form 1099) showing the proper recipient.

Please refer your reply to the personal attention of the undersigned.

Respectfully,
Chas. T. Russell
Deputy Commissioner.

He denies having received the money

October 31,

Mr. Charles T. Russell, Deputy Commissioner,
Treasury Department,
Washington, D. C.

IT:E:CTR

Dear Sir:

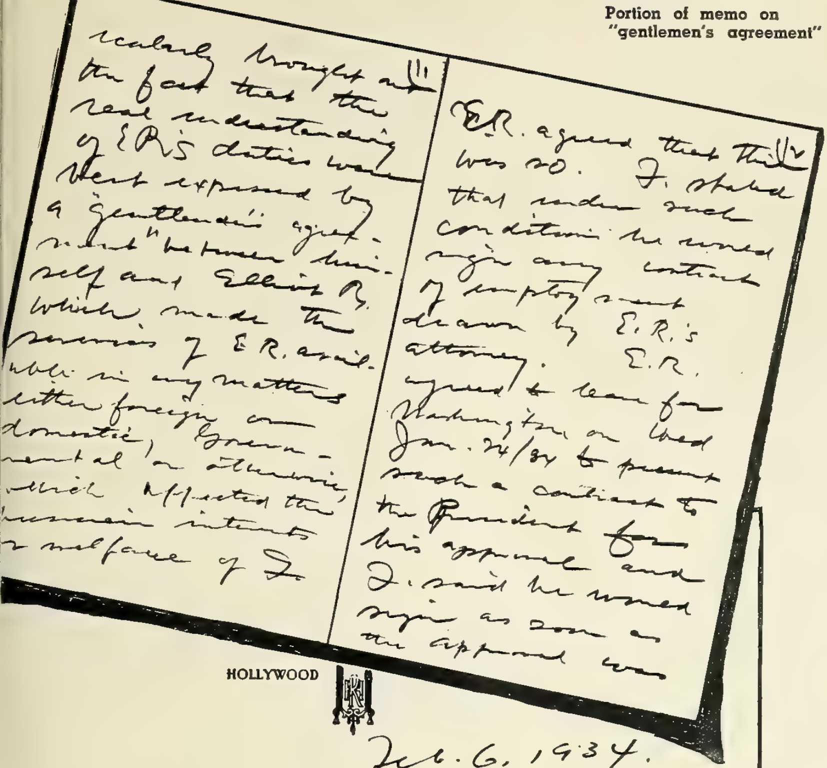
On behalf of Mr. A. H. G. Fokker, who is absent in Europe, I am replying to your letter of October 30th raising the question of paying $5,000.00 to Elliott Roosevelt. I enclose herewith copy of a letter-contract between Mr. Fokker and Mr. Roosevelt. You will note that on the second page Mr. Roosevelt acknowledges receipt of $5,000.00 on behalf of a corporation to be formed. To the best of my belief and knowledge this corporation has never been formed, and as a consequence in filing form No. 1099 for Mr. Fokker I recorded the payment of $5,000.00 to Mr. Roosevelt.

The original of the enclosed copy of the letter-contract is in possession of the Special Senate Committee investigating the Munitions Industry, the Chairman of which is Senator Gerald P. Nye.

Very truly yours,

Enc.

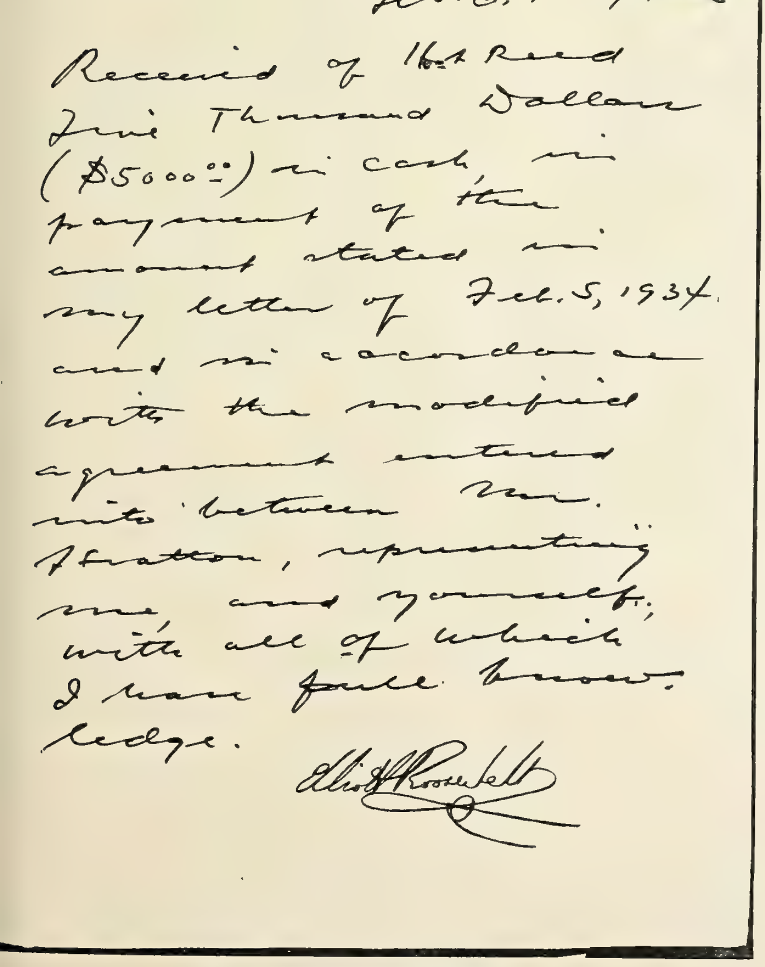
Fokker's agent insist Roosevelt got paid



ically brought out the fact that the real understanding of E.R.'s duties was best expressed by a "gentleman's agreement" between himself and Elliott R. which made the services of E.R. available in any matters either foreign or domestic, Governmental or otherwise, which affected the business interests or welfare of F.

E.R. agreed that this was so. F. stated that under such conditions he would sign any contract of employment drawn by E.R.'s attorney. E.R. agreed to leave for Washington on Wed Jan. 24/34 to present such a contract to the President for his approval and F. said he would sign as soon as the approval was

Portion of memo on "gentlemen's agreement"



HOLLYWOOD

Feb. 6, 1934.

Received of H.A. Reed Five Thousand Dollars ($5000.00) in cash, in payment of the amount stated in my letter of Feb. 5, 1934. and in accordance with the modified agreement entered into between Mr. Stratton, representing me, and yourself, with all of which I have full knowledge.

Elliott Roosevelt

Roosevelt's receipt for $5000

Reed took the letter to Fokker. Fokker telephoned his fiscal agent in New York, Carter Tiffany, who promptly transferred the money to Los Angeles. The following day, February 6, Elliott called at Reed's house and was handed the denominations he had asked for—four $1000 bills and two $500 bills. He signed a receipt Reed had written out, as follows:

"Received of H. A. Reed Five Thousand Dollars ($5000) in cash, in payment of the amount stated in my letter of February 5, 1934, and in accordance with the modified agreement entered into between Mr. Stratton, representing me, and yourself, with all of which I have full knowledge."

The term "modified agreement" meant gentleman's agreement, and the agreement was that Elliott was to sell convertible fighting planes to Soviet Russia and also was to participate in promotion profits of the domestic air mail monopoly, when, as and if——

They Devise a Code

A few hours after handing Elliott the $5000 Reed was on his way to New York to get the promoting started. Elliott told him the first thing to do in Manhattan was to call on Basil O'Connor—law partner of Franklin D. Roosevelt. With such big doings afoot the four conferees—Fokker, Reed, Roosevelt and Stratton—agreed they'd better have a code. Here is part of the one they devised for use in communicating with one another:

President Roosevelt	Rochelle
Elliott Roosevelt	New Rochelle
Military	Industrial
Douglas	Drive
Fokker	Chain
Reed	Wheel
Stratton	Spare
Lockheed	Brake
Baruch	Beta
Moffett	Gamma
Amtorg	Ruyork
Hanshue	Fear
Industry	Game
Germany	Geraldine
Italy	Ivy
England	Ellen
France	Frankie
Russia	Rudolph
Moscow	Mosely

Having asked Elliott to send him a letter to the Waldorf Astoria summarizing his understanding of what the administration wanted in the way of a new set-up for the air mail, Reed, with hope in his heart, flew eastward. On February 8 he called on Basil O'Connor, who said he had heard from Elliott but didn't quite know what this new proposition was all about. He couldn't discuss it, he said, until he had talked to the "Chief" in Washington. Reed better wait and come back tomorrow.

With tomorrow (February 9) arrived a letter from Los Angeles signed only with the typewritten code word "Spare." Its proposals and language bear many similarities with the proposals and language employed by President (Rochelle) Roosevelt four weeks later when he sent a message to Senate committees outlining the administration's policy for new air mail legislation.

Taking "Spare's" letter to O'Connor, Reed was greeted by the President's law partner as "one of the family." "Spare" had suggested that at the head of the new syndicate to consolidate the major airlines there be a man of such standing as Bernard M. Baruch, Frank Walker, John J. Raskob, James A. Moffett or Walter Chrysler.

Dovetailing Perfectly

A few hours after Reed took leave of O'Connor the afternoon newspapers announced the cancellation of all domestic air mail contracts. Then Farley called the army fliers to their rendezvous with death.

Young Mr. Roosevelt and his colleagues had another rendezvous. On February 13, after calling on O'Connor and going over points he deemed necessary in air mail legislation to make his plan workable, Reed telephoned Elliott Roosevelt and did $75 worth of talking, the young man copying down the notes Reed read. To what destination Elliott transmitted them the reader can assume, but the administration air mail bill introduced on March 9 incorporated all of Reed's recommendations.

Within the next few weeks, during two visits to New York, Reed's telephone communications with Elliott and Stratton cost several hundred dollars. Most of them were calls incoming to New York from Los Angeles "charges reversed." Many of these calls originated at Elliott's home telephone—Oxford 4000—in Beverly Hills. No part of Elliott's $5000 was being used for telephoning.

On February 16 three army officers —Second Lieutenants Jean D. Grenier, Edwin D. White, Jr., and James Y. Eastman, were killed flying to their air mail posts.

On February 17 Reed completed the first prospectus of his air mail consolidation plan and sent copies to Elliott Roosevelt.

On February 19 Reed sent copies of his prospectus to Basil O'Connor and to E. F. Hutton & Co., underwriters who had been in touch with airline operators. Then Reed took a mail-less commercial plane to Los Angeles.

On February 21 Fokker and Reed called at Elliott's home, where young Roosevelt expressed annoyance that Reed hadn't included Frank Walker's name in the list of suggested heads for the new corporation.

On February 22 Lieutenants Durward Lowry and I. F. Pattrick were killed and Second Lieutenants Charles P. Hollstein and Harold L. Dietz were injured flying the mails.

On February 23 Second Lieutenant George F. McDermott was killed flying the mails.

On February 24 a delegation of Soviet aeronautic engineers headed by Schumanoff arrived in Los Angeles, were taken by Stratton to the Lockheed plant at Burbank, and there met Elliott Roosevelt. Previously Fokker had constructed a mock-up of a Lockheed Electra as converted by him for military use and this the Russians were shown by Elliott Roosevelt.

On February 25 Stratton and Reed escorted the Russians on a flight over Los Angeles and under Elliott Roosevelt's by-line, the newspapers carried a story saying there was going to be "a real new deal" for aviation in this country, the details of which would be known in a few days.

Prospects of "Fat Pickings"

Three days later, just before accompanying Reed to New York, Fokker signed a contract wherein Elliott Roosevelt acknowledged receipt of $5000 as part of a $25,000 annual retainer, the balance to be paid in three installments of 90-day intervals from February 6. The agreement also provided that Elliott should get half the profits from any planes sold to Soviet Russia. The price Reed subsequently told Stratton to quote to the Russians provided $20,000 profit per plane, so, had 50 been sold (as was expected), Elliott would have had a nice "Raw Deal" half million. If an order for "a substantial number" was not placed by the Soviet Union by May 6, the contract provided that Elliott should return the $5000 and forego the three prospective payments of $6666.66 each. But alas, the Russians, to begin with, protested that the price was too steep, even with Roosevelt's son as go-between, and the Johnson bill, to end with, denied them the loans they had expected.

Meanwhile there was prospects of even fatter pickings from the aviation industry for the son of the President who was damning it so fiercely. The syndicate which the prospectus sought as window dressing for the consolidated concern was to be asked to pay $2,000,000 from $1,800,000 worth of common stock in nine equal parts. A tenth slice of $200,000 worth was to go to the promoters for their efforts—half to Fokker and Reed, the other half to Elliott. Under the set-up and the legislation contemplated by Reed the new corporation would, he estimated, earn at least $15,000,000 annually from air mail alone with revenues from express or passenger service just so much velvet.

This would give Elliott another "Raw Deal" $750,000 annually—not bad even for a "Prince of Privilege!"

On March 3 Reed asked me to approach my then editorial associate, Former Governor Alfred E. Smith, and invite him to become the head of the proposed corporation. Reed said: "Washington would be more than happy to have Smith taken care of." Three days later—March 6—I told Reed that Governor Smith said he would have nothing to do with it, since he was completely out of sympathy with the Roosevelt policies.

The following day President Roosevelt, in a letter to the interested Senate committees outlined his policy for new air mail legislation. In general it incorporated most of the proposals of the Reed prospectus, except that of putting first class mail in airplanes to give capacity loads on all flights. That proviso, however, was embraced in the administration's bill introduced in Congress on March 9.

On March 9 five army men were killed flying the mails. They were Lieutenant Otto Wienecke, Second Lieutenant William Reid and Sergeant Ernest P. Sell and Second Lieutenants Frank L. Howard and Arthur Kerwin.

There are several illuminating, if not inspiring, points of similarity between the "Spare" letter sent to Reed from Los Angeles on February 7, the Reed prospectus of February 17, and President Roosevelt's letter to the Senate committees on March 7. As for example:

* * * * *

"Spare" letter: "Whereas airline operators have in the past vigorously fought against inclusion under the Interstate Commerce Commission, they will not be able to avoid inclusion under the proposed new set-up."

Reed's prospectus: "To close observers it is quite apparent that the administration intends to reorganize the Interstate Commerce Commission into two divisions, one of which will regulate transportation systems, including airline operations."

President Roosevelt's message: "It is my judgment that six months before expiration of the contracts made under competitive bidding, the Interstate Commerce Commission should pass upon the question of public convenience and necessity of air mail routes and thereafter fix a maximum rate of air mail pay. Knowledge that the Interstate Commerce Commission, a judicial body, will hereafter regulate air transportation routes and air mail pay will remove uncertainty as to routes and mail pay."

* * * * *

"Spare" letter: "At no time should this corporation appear as an out for the present big operators. In other words, this whole operation must at no time appear to be a subterfuge and its structure should be manned by men who are in no way aligned with the industry at present."

Reed's prospectus: ". . . A group of men, who are thoroughly experienced in airline and air mail operation but who at present are not actively connected with the aviation industry propose and suggest the adoption of the plan outlined herein." . . . ". . . in order to comply with the apparent intent of the administration only 35 percent of this item (common shares) as total should be subscribed by the three major and some of the minor corporations, the other 65 percent being subscribed by others who are in no way connected with present airline operating interests."

President Roosevelt's message: "Obviously, also, no contract should be made with any companies, old or new, any of whose officers were party to the obtaining of former contracts under circumstances which were clearly contrary to good faith and public policy."

* * * * *

"Spare" letter: "At all times it must be borne in mind that in building this corporation the manufacturer must be completely divorced from the operator, that there be no interlocking directorate or reciprocal stock ownership."

Reed's prospectus: "Briefly the plan contemplates segregation, so far as the three major and some of the minor aviation corporations of the country are concerned, of the flying equipment, ground facilities and necessary personnel for airline operation from the manufacturing activities of these corporations."

President Roosevelt's message: "I suggest that the proposed law prohibit the award of an air mail contract to any company having connection with subsidiaries, affiliates, associates or holding companies directly or indirectly by stock ownership, interlocking directorates, interlocking officers or otherwise, if said subsidiaries, affiliates, associates, or holding companies are engaged directly or indirectly in the operation of competitive routes or in the manufacture of aircraft or other materials or accessories used generally in the aviation industry."

* * * * *

On March 16, telephoning from Los Angeles to New York, Elliott Roosevelt instructed Reed to get Frank Walker's acceptance as chairman of the new corporation. The next day Reed called at Walker's office at Democratic headquarters at the Biltmore. Walker's secretary said he was going to Walker's house and would transmit the message. While Reed was there Jim Farley came in. Farley and Walker's secretary left the office together. Reed received no word from Walker. Farley had an air mail plan of his own.

Politics Steps In

On March 22 Stratton wrote Reed that he was "functioning on the air mail proposition." The letter continued:

"Politics seem to have gotten into this to such a terrible degree that it is almost impossible to predict what the outcome will be, but you may rest assured that both E. and I are working with you on the matter.

"Enclosed you will find our contract with Fokker. I witnessed Fokker's signature and left Elliott's blank, for your name on the paper. I hope I will receive tomorrow the price list on Lockheed, as the Russian delegation will arrive here Saturday, and they have already requested prices from us."

The following day Reed wrote a letter to Fokker in Amsterdam reporting he had sent Stratton information to use in case he were asked to quote prices to the Soviet Union for "fifty Fokker military conversion type airplanes—in outward appearance somewhat similar to the Lockheed Standard Transport Airplane . . .

"I gave him a price per airplane of $57,834 without motors, propellers, starters and generators. The price of $57,834 includes $20,000 profit per airplane which is to be divided equally between Elliott Roosevelt and yourself."

Disappointed at the turn air mail affairs seemed to be taking, Reed telephoned Stratton on March 27, the day President Roosevelt left for Miami on a fishing trip aboard Vincent Astor's *Nourmahal*. He told Stratton he might as well return to Los Angeles, but Stratton suggested that Reed remain in New York, explaining that Elliott was about to fly to Miami to take the matter up with his father.

On March 30 Lieutenant Thurman A. Woods was killed flying the mails.

On April 1 Stratton advised Reed that Elliott would want to see him in Washington immediately upon his return from Miami. Reed went to Washington on the third and on the fourth received a telegram from Richmond, relayed from his New York hotel, which read:

"Arrive Washington soon as you can communicate White House—E.R."

Reed joined Elliott for breakfast at the White House the next morning.

"Father thinks your plan is the soundest approach to the problem," Reed was told. "Mother agrees. I talked the whole thing over with her last night. She remarked that the proper settlement of the air mail problem and full support of the Subsistence Homestead Projects should be the first order of business with the Administration.

But there were some immediate prospects that were decidedly disturbing, Reed learned as the conversation progressed. It seemed, Elliott told him, that there were some "political pressures" being exerted, (Remember—Farley had an air mail plan of his own) and so strong were they that Reed's plan for a consolidation would have to wait awhile. In the meantime Father had instructed him to find out if Reed couldn't be satisfied with a transcontinental route from Seattle to New York, via the Twin Cities. Reed said no. In that case, Elliott said, Father wanted him to get in touch with Farley and Attorney General Cummings to see what could be done to restore the original scheme.

Elliott told Reed he would see them that day and then get in touch with him.

A Call That Never Came

For seven days Reed waited in Washington for a call from Elliott. Whenever he tried to communicate with the young man at the White House he was told Elliott was not there. Appealing to Stratton to solve that riddle he received on April 12 the following telegram:

"Cannot understand Rochelle silence. Heard nothing since left here. Russian delegation here week. With them continuously. Very much impressed. Will report New York next week on their arrival. Purchasing commission due here near future. Will handle myself. Expect favorable results. Keep me posted your activities. Trying to contact Rochelle now. Regards. G. W. Stratton."

Hearing nothing from the White House, fed up with waiting, Reed finally left Washington for New York on April 14, and went on to Los Angeles. Almost thirty months passed before he saw Elliott Roosevelt again. By chance they were passengers aboard the same Texas-bound plane out of Washington on September 4, 1936. Reed spoke to Elliott Roosevelt, but the young man did not reply.

And there were so many things they might have talked about! Let us return to that spring of 1934 and see.

As of May 1, 1934 Elliott was employed by the Aeronautical Chamber of Commerce as a vice-president at $10,000 a year. It was not until June 14 that public announcement of his new job was made, and it was not until May 22 that Stratton told Reed about it. Meanwhile, on May 9, Fokker's fiscal agent in New York, Carter Tiffany, had instructed their New York bankers to "draw a check payable to Elliott Roosevelt for $6666.66," and charge Fokker's account. He mailed the check to Stratton the same day. The next day Fokker cabled Tiffany to cancel Elliott's contract. After all, May 6 had come and gone and no airplanes had been sold to the Russians.

Negotiations for cancellation "by mutual consent" were begun. On June 12 Tiffany addressed to Elliott at the White House a letter saying "Mr. Fokker feels that while no business has resulted from this contract, he nevertheless appreciates your efforts and for this reason is willing to excuse the return of the original $5000 paid you, but he has instructed me to cancel only upon the return by you of the second payment of $6666.66." But somewhere, somehow, the check had disappeared. As this is written it still hasn't bobbed up anywhere. On June 20, 1934 Reed wrote Tiffany that Stratton "is now of the opinion that the letter with the check enclosed was either lost in transit or was sent to Holland by mistake." The following day Tiffany received from Poughkeepsie (about 6 miles from Hyde Park) the following telegram:

"Due to a mixup of some letters in Washington the check that I was returning to you was unavoidably delayed but will be in your hands in the next two or three days. Many thanks for your letter. Elliott Roosevelt."

One week later, on June 28, Tiffany wrote young Roosevelt at Hyde Park, enclosed his cancelled copy of the contract, and informed him he had that day instructed that payment be stopped on the check "in order to avoid any further difficulties arising from the misplacement of the check in question, and to obviate any unauthorized person from making use of it if it should come into improper hands."

Investigation and Denials

That autumn the Nye Committee investigating the munitions industry learned of the Fokker-Reed-Stratton-Roosevelt deals. Armed with a subpoena bearing Senator Gerald P. Nye's signature a Senate process server, Donald Y. Wemple gave Tiffany, on December 3, 1934, a receipt for a "complete file of papers relating to certain agreements and cancellation thereof, between Mr. Anthony H. G. Fokker and Mr. Elliott Roosevelt." The same day Fokker's bankers wrote to Wemple of the drawing of the $6666.66 check against Fokker's account in Elliott's favor, of stopping payment on it, and of never seeing it again.

Another branch of the government—the Internal Revenue Department—heard about the $5000 payment. It got at least two versions of that, as the following letters testify:

Treasury Department
Washington, D. C.
October 30, 1935

Office of Commissioner of
Internal Revenue
Mr. A. H. G. Fokker,
Alpine, New Jersey
Sir:

An information return (Form 1099) filed by you for the calendar year 1934 shows $5000 as having been paid to Mr. Elliott Roosevelt during that year. Mr. Roosevelt disclaims any receipt of the payment, stating that the payment was received by a Mr. Grenville W. Stratton, 6626 Franklin Avenue, Los Angeles, California. In this event, you are requested to forward a corrected information return (Form 1099) showing the proper recipient.

Please refer your reply to the personal attention of the undersigned.

Respectfully,
Charles T. Russell,
Deputy Commissioner.

October 31, 1935

Mr. Charles T. Russell, Deputy Commissioner
Treasury Department,
Washington, D. C.
Dear Sir:

On behalf of Mr. A. H. G. Fokker, who is absent in Europe, I am replying to your letter of October 30th raising the question of paying $5000 to Elliott Roosevelt. I enclose herewith copy of a letter-contract between Mr. Fokker and Mr. Roosevelt. You will note that on the second page Mr. Roosevelt acknowledges receipt of $5000 on behalf of a corporation to be formed. To the best of my belief and knowledge this corporation has never been formed, and as a consequence in filing form No. 1099 for Mr. Fokker I recorded the payment of $5000 to Mr. Roosevelt.

I was not present at the time the $5000 was paid to Mr. Roosevelt, so I do not know whether he received it directly or through Mr. Stratton, but there seems to be no doubt as to the intention at the time that Mr. Roosevelt was to receive this money and afterwards pay it into a corporation to be formed.

For your information this contract was subsequently cancelled and no other payments were made to Mr. Roosevelt or to Mr. Stratton by Mr. Fokker.

The original of the enclosed copy of the letter-contract is in possession of the Special Senate Committee investigating the Munitions Industry, the Chairman of which is Senator Gerald P. Nye.

Very truly yours,
Carter Tiffany

On September 30, 1935—one month before the foregoing exchange of correspondence, Elliott Roosevelt resigned his post with the Aeronautical Chamber of Commerce. In one year and five months his salary had approximated $14,000. From May 1, 1934 to February 4, 1935 there was no fixed travel expense agreement, but beginning February 5, 1935 he was to receive $5000 a year for travel expenses. Between then and the time of his resignation approximately $3300 was paid him on that item.

Of those figures no doubt the Internal Revenue Department has taken cognizance. What it may not know is the fact that after the Great Dream ended in the spring of 1934, Stratton unsuccessfully sought to have Reed give him Elliott's signed receipt for the $5000 binder payment on the Fokker contract.

Reed quotes Stratton as saying: "I have personally assured the President that all papers involving Elliott have been destroyed."

Reed states Stratton telephoned him in March, 1935, "I just wanted to tell you that I got that $5000 and not Elliott, and *I* have declared it on my income tax return." And on October 2, 1935, the day President Roosevelt arrived in Los Angeles en route to the San Diego Exposition, Stratton got in touch with Reed again. He had heard, he said, that after Nye Committee investigators had collared Fokker, the Dutchman had told them about Elliott's part in the Russian agreement. If called before the committee Stratton said he would say *he* got the $5000—not Elliott—and he asked Reed to testify the same.

Roosevelt Goes on "Relief"

Here we have the President's son trying to muscle into the air mail business at the very time his father is publicly flailing it. Here we have a President who publicly declaims "I hate war!" when, as a matter of official record, his son dickered with a foreign government to sell it convertible military planes made in the United States. Here we have Senator Gerald P. Nye, head of the munitions investigating committee, smearing mud on such dead Democrats as Woodrow Wilson and Robert Lansing and on such live Republicans as the duPonts, while keeping silent about the doings of a live Democrat, a member of the President's family, whose activities were made known to Nye's committee through its acknowledged receipt of "a complete file of papers relating to certain agreements and cancellations therof, between Mr. Anthony H. G. Fokker and Mr. Elliott Roosevelt." Here we have Elliott Roosevelt accepting a $5000 retainer in cash, and then telling the Internal Revenue Department that somebody else got the money.

And when his colossal schemes collapsed, his dream of a million a year faded. Elliott sought "Relief" — he joined Father's good friend, O. Max Gardner, former Governor of North Carolina on the payroll of the Aeronautical Chamber of Commerce.

Mr. President, Mr. Farley, Mr. Nye, Mr. Morgenthau, et al—can you grin this off?

Controlled Lighting For Landing During Zero—Zero Conditions

J. B. BARTOW
Bartow Beacons, Inc.

● Experimentation directed 'toward a practical solution of landing aircraft during conditions of poor visibility (snow, fog, dust, smoke and rain) has embraced radio, instruments, sound, lights, gyro-pilots and various combinations of such devices. Those working on developments along these lines deserve credit for the advancement of valuable information which, if not actually used at the time of landing, aids materially in the technique preceding the landing.

Since a visual contact system of landing that is workable would be the most practical and preferred system, we will only consider this method and set forth means to its solution.

Hourly weather reports are a permanent record of wind velocities and directions under poor visibility conditions over a period of time. Therefore, the number and direction of runways that must be prepared in different localities can be definitely determined. At present, with the exception of the records stating zero-zero conditions (which are rather broad) no measurements are made to accurately determine the density of these conditions in different localities. There have been, however, scientific studies of transmission of light through various atmospheric conditions. From these there have been prepared formulas which enable an accurate determination of the amount of candlepower which is necessary for a light to be visible at a given distance, provided the density of the atmosphere under consideration is known.

Although measurements have been made on and around Cape Cod, they are of no value in determining how dense the visibility becomes in other sections of the country. These measurements could be easily made with inexpensive equipment and incorporated in the weather records by the present weather observers, and it is hoped that in the near future steps will be taken to secure this valuable information. Until such time, it is the author's opinion that inasmuch as he has measured fog with 10^{-30} transmission and has seen snow storms which were slightly denser, that a transmission of 10^{-40} must be prepared for.

Candlepower is that factor of light which determines its penetration. The minimum forward visibility that will enable a pilot to accurately judge his height and direction relative to the runway is 500 ft. From the accompanying transmission chart (figure 7) it is seen that when a transmission of 10^{-40} exists, a minimum of 8000 candlepower will be necessary to make a light visible.

The most critical period during a landing, under conditions of poor visibility, is just as the plane contacts the ground. At this time lights must be visible from a point 10 to 20 ft. above the center of the runway which is the level of a pilot's eye when landing. If forward visibility at this time is 500 ft., a pilot can correct for wind drift, richochet, prevent ground looping and avoid dizziness brought on by the necessity of continuously refocusing the eyes on close lights being passed at high speed.

Since the radio will undoubtedly be used for navigation, traffic control and for lining up on the correct approach during poor visibility, radio and the contact system of lighting must overlap, the most practical place being at the last radio marker on the approach system just outside the landing area. While most radio markers are 1500 ft. from the beginning of the landing runway (at which point the plane is supposed to have 200 ft. altitude) the lighting system should be carried out 500 ft. beyond this point and be visible from an altitude not less than 300 ft. over the center of the approach.

Since direct light (the only type of light of value under poor visibility) has a limited range, it is necessary that the pilot be guided into range of the lights. This can be accomplished by the installation of a Bartow light beacon at the beginning of the lighting approach system and by directing the pilot by radio down the approach within range of the beacon. This will enable the copilot to see the beacon and then coordinate the radio and light systems. From the beacon the pilot can then line up on the middle of the lighted approach system and come in to a landing. Under moderate weather conditions where a ship is not equipped with radio, the light beacon will direct the pilot, in the vicinity of the airport, to the point from which he can begin the correct approach for landing.

Color has an important place in lighting, but its use must be guided by knowledge of its characteristics and limitations. Some people assume that all that is needed to develop a light that will penetrate fog is to discover the correct color; others believe that if the light comes from a gaseous tube such as neon, sodium or mercury vapor, it has better fog-penetrating characteristics than other colors of light. Both of these conceptions are erroneous.

White light, such as sunlight, contains all colors or wave lengths. The sun does not actually change color between noon and sunset. Yet it often appears red or yellow at sunset or sunrise, this change occurring because the sunlight is screened through more of the earth's atmosphere when it is low in the heavens than when overhead. Small particles, such as haze, dust and smoke in the atmosphere close to the earth's surface, reflect the blue wave lengths (giving us the blue sky) but permit the red end of the spectrum to penetrate (giving red or yellow sunsets). When a moisture cloud (which is the same as fog) passes in front of the sun, the only difference observed is a dimming of the sun. On an overcast day when there is nothing but diffused or reflected light from the clouds, it is observed that the light is white, indicating that all colors have penetrated equally.

Since different colors have different refracting values, these are sometimes separated, thus forming a rainbow which is further proof that all colors have penetrated equally. When the sun is observed during a dust storm, it will have a yellow tint, similar to sunset, and sometimes almost a red hue, and pilots operating from airports where there is considerable smoke will notice that on smokey nights the beacon and other clear lights have a yellow tint.

There are two main sources of color. The incandescent lamp which uses a relatively small point source filament. This radiates an almost white light or con-

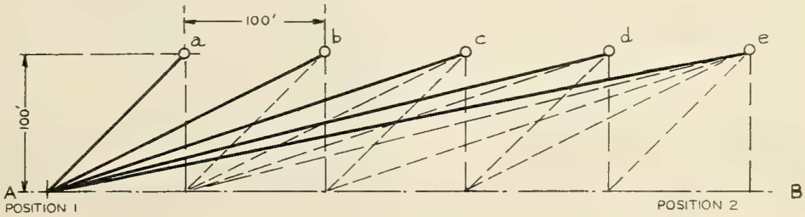


Fig. 1: Diagram showing layout of projectors and observation positions

Fig. 2: Row of uncontrolled lights in fog

tinuous spectra, color being obtained by placing a color screen in the light path, which while it permits only the desired wave length or color to pass through greatly reduces the candlepower, i.e., it takes 5 c.p. white light to produce 1 c.p. of aviation green. However, with a small light source it is possible to collect the light and concentrate it into high b.c.p. as for example concentrating the light from a 32 c.p. auto headlight bulb into a 100,000 c.p.b. The other source of color is a bright line spectra from a gaseous tube (neon, sodium or mercury vapor) which radiates light of one wave length or color depending on the gas in the tube and eliminates the need for a color screen. However, due to the large source it is neither possible to concentrate it into high enough b.c.p. to be of any value nor control the distribution which is necessary.

The blending or mixing of colors is a point which must be carefully considered. For example: A blue light placed behind a row of yellow lights, so that it must be observed through the halo or reflected yellow light, will appear to be green; a yellow light placed behind a row of blue lights, will also appear green. This is important when colored lights designate a certain location or are intended to convey a definite meaning to the pilot.

It is essential that the pilot knows his position relative to the runway. This can be accomplished by using green lights for approach, clear or white lights for the first half of the runway, a safety zone of yellow lights for the next 500 or 600 ft., and then red lights for the remainder of the runway. This method of zoning the runway eliminates the possibility of interference of color, and the possibility of missing a position marker due to the malfunctioning of a single light.

Early airports had all-way sod fields, but with the improvement of airplanes and the increasing use of brakes, these were modified into hard surfaced runways in several directions. When sufficient number of runways are provided to permit the landing into the wind, transports always use only the runways. Some fields installed flush type runway lights so that under normal conditions at night they designated the runway and guided the pilot onto the runway. Due to their relatively low b.c.p., however, they are useless during poor visibility conditions. Their low candlepower and the impossibility of getting the light to leave the surface of a lens less than 45° to the surface, leaves small hope of utilizing a flushed type of light. Even if it was possible to design a light with sufficient b.c.p., and one which could be directed at the necessary low angle to the surface of the runway, it would be useless during winter months or dust storms when snow or dust covers it. There is a popular misconception that these lights would be sufficiently hot to melt snow which fell on them. However, even if there was sufficient heat to melt through a heavy layer of snow, the lights would be invisible to an approaching airplane and they would create a diffused light. Therefore, the lights must be off the ground.

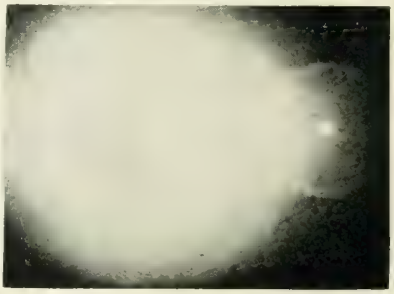


Fig. 3: Uncontrolled light in fog

Many operators and pilots have agreed that since they only use the runway (where there are sufficient number of approaches and runways to allow into the wind landings), that raised lights making the runway visible will be less hazardous than a runway which is inadequately lighted.

The eye is the "receiving set" of the pilot and must be taken into consideration as part of the system. Due to the construction of the eye, when the iris is wide open, we can see or distinguish lights of much fainter value. For example, when we first go into a dark room from a well-lighted room, it is impossible to distinguish faint objects, but after a period of time, i. e., when the iris has opened wide, faint objects become visible. When observing the heavens at night, much fainter stars are visible after the iris of the eye has opened wide. The stars shine in day as at night, but of course are not ordinarily visible because the brightness of the sun stops down the iris, but it is possible to go down into a deep shaft and after the iris of the eyes have opened wide, the stars become visible. During a recent stratosphere flight the observers upon reaching the stratosphere reported that the sky became dark, but they were unable to see any stars. The darkness of the sky was due to absence of particles in the atmosphere to reflect the sunlight. The reason they were unable to see the stars was because the interior of the gondola was bright, thus stopping down the iris of the eyes of the observers. Had they covered the port holes excepting those on the opposite side from the sun, the interior would have been dark due to absence of reflected light and the eyes of the observer would have been at their maximum sensitivity and they could have seen the stars.

The retina of the eye upon which the image is projected, is sensitive to light and when any highlights fall upon it the iris immediately stops down and controls the amount of light which is permitted to fall upon it. Although it works automatically, it requires a definite time to function properly and should a bright light shine into the eyes when the iris is wide open, the image is burnt on the retina of the eye (often referred to as white spots or light blindness, which appears to be before the eye even when the eyelids are closed). A lighting system must take this fact into consideration and the lights be so designed and controlled that at no time during landing will any light fall upon the eye which will impair its maximum efficiency by causing the iris to stop down or leave false images on the retina.

Fig. 4: Row of controlled lights in fog

Fig. 5: Controlled light in fog

While the transmission chart is true for a single light it does not hold true when more than one light is to be considered. This is due to the change of illumination of the atmosphere and the effect of the increased illumination on the eye, i.e., when a light just visible in fog is being observed, and a second light is lit between it and the observer, the former becomes invisible, due to the reflected light on the atmosphere around the nearer light becoming brighter than the first. Applying this to a row of lights, it is found that instead of being able to see six or seven lights, that the area over the runway has been illuminated to such brightness that only the first few lights are visible.

A much-used system of lighting for open air theatres where it is impractical to use a screen or curtain, is a battery of flood lights which shine toward the audience, making it impossible for the audience to see past the bright lights. This system works even more efficiently when applied in fog, snow or rain. The halo in the fog is caused by light shining on the fog at an angle to the direct line of observation and being bright enough to reflect off the drops of moisture, making them visible. When the distribution and intensity is controlled so that only the direct light (with just sufficient candlepower) penetrates to the point of observation, the light appears as a point source and the halo or fogging of the atmosphere about it is eliminated.

Applying this development to a landing system, the point of observation is always in a vertical plane down the center of approach and runway. Therefore, all lights must be so designed and controlled that when any light from the projectors reaches any point in the vertical plane, it must have a predetermined uniform value at such point of intersection. In figure 1, the line A-B, represents the vertical plane down the center of the runway; letters a to e, represent runway light projectors. The light from each projector is so distributed and the candlepower so controlled, that when the light reaches the plane A-B, it will be of equal value. Therefore, at all points along A-B, all lights will appear as of the same value. Figure 2 is a photograph of a row of lights without control arranged the same as the projectors in figure 1, and photographed from position 1. Figure 3 is a photograph taken from position 2 of light projector e, without any changes, excepting changing position of observation along line A-B. When there is no attempt to control the light and all lights are of the same candlepower, the nearest is always the brightest. In moving from A to B, each light grows brighter as it is approached, as illustrated when projector e was photographed from position 2. If under the same atmospheric conditions we substitute light projectors which have the correct distribution of light with the correct light intensity, then when the lights are observed from position 1 on line A-B, they will appear as photographed in figure 4. As the observer moves along line A-B, all lights will continue to appear the same and upon reaching position 2, projector e will appear as photographed in figure 5, having the same brightness as when observed from position 1 (figure 4). Figure 6 is a photograph taken from position 1 of projectors b,c,d,e, illustrating the effect of different intensities and distributions. Projectors b and e have the correct distribution, but too much intensity; projectors c and d have both poor distribution and intensity. All photographs were taken during the same fog conditions with a moving picture camera to assure equal exposure, developing and film values.

In actual observation, the difference of figures 2 and 4 is far greater than shown by the illustrations because the iris of the eye automatically closes whereas the iris of the camera in all pictures was kept at its maximum opening.

Since intensity as well as distribution must be of a definite value, it is necessary that the intensity of the light projector be controlled according to the transmission of the atmosphere. This can be done by regulating the voltage of the lamps or by the use of multiple filaments, both methods being controllable manually or automatically with a photo-electric cell.

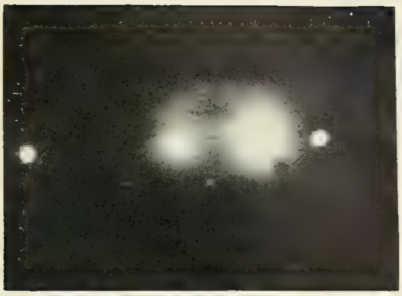


Fig. 6: Variation of partial control in fog

With the application of this development it is possible to maintain the maximum distance at which each light can be observed or be visible. This makes it possible for 7 lights to be visible, giving a forward visibility of 600 ft. when atmospheric condition is such as to have the low transmission factor of 10^{-40}.

Like most major problems, once the physical limitations are established and the known factors are coordinated and properly applied, the solution is relatively simple. In the case of solving for visual landings during poor visibility, the limitations are clear and definite, and therefore it is not what we would like to do, but what we must do, to solve the problem.

While this development in lighting is a solution for visual landings during poor visibility its utility depends upon the proper coordination of radio, traffic control, adequate number of runways with radio approach and other navigation aids which it also helps to simplify.

The type of lighting system here proposed will be more expensive than present systems. However, it will represent only a small percentage of the total cost of a modern air terminal, and promises to more than pay for itself by the elimination of cancellations due to weather, not to mention the increase in air travel due to the feeling of security to passengers in man's conquest of time and space.

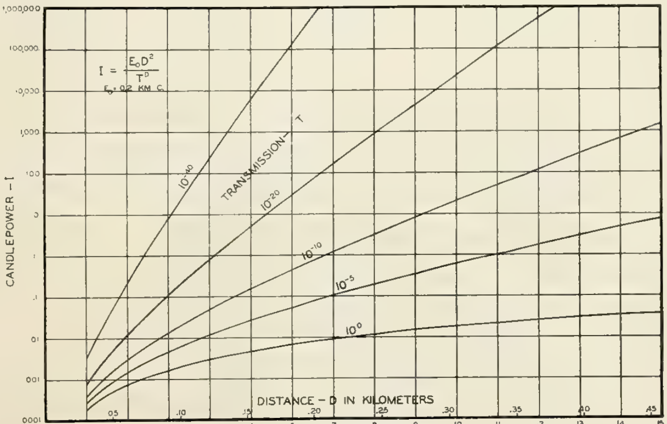
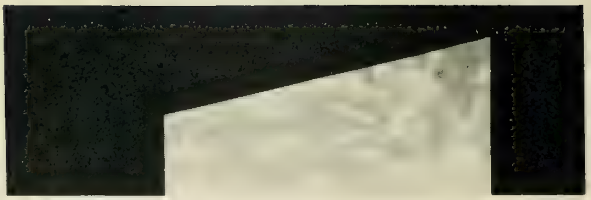


Fig. 7: Light transmission chart showing amount of candlepower needed for penetration at various distances and transmissions



OPPORTUNITIES FOR AIRLINE TRAFFIC PERSONNEL

J. B. WALKER

Vice-president & General Traffic Manager
Transcontinental & Western Air, Inc.

● While we in the air transport business are elated over the continually increasing traffic and are anticipating the million-passenger goal to be reached this year for the first time in airline history, we are keenly interested in the causes of this increase.

Improved airline operations, developed navigational aids, more efficient transport planes, and the frequency of schedules to more important cities undoubtedly have contributed much toward this increased acceptance of air travel. But if these reasons alone are responsible for the increase in traffic volume then our potential market has not been touched to any great extent.

Selling Air Travel

A person who walks into an airline ticket office or a travel agency and requests a reservation on an airline is a buyer. Either he has made up his mind to fly from curiosity or because of an emergency, or he has been sold on air travel in the past and can be considered a regular airline patron.

If he is a voluntary buyer, he may have been influenced by advertising or by the efforts of a traffic representative who has had the tenacity to call repeatedly on the prospect. If he is a regular airline passenger, then he has been sold in the past and his patronage and good-will retained through service and attention. Through conversation, the regular airline passenger frequently is responsible in influencing a first-rider to try air travel. It is evident then that selling prospective airline passengers, and retaining their patronage are the means of creating new business.

An airline traffic representative who calls repeatedly on a prospective passenger and gradually dissolves the barrier presented by the prospect to the culmination of a sale actually has sold air transportation. His efforts may have taken several months but they have resulted in a first trip and the ultimate securing of another airline passenger. Retaining his patronage is a matter of attention and service on the part of everyone in the company. It is necessary that his reservation and booking be made competently, that his baggage be routed properly, and that he be made to feel that he is the guest of the transport line.

Salesmanship is developed in training. It requires the proper use of psychology in all its forms in that each prospect may present a different reason why he never has used air travel and why he intends never to fly. He may claim that his family doesn't permit him to use air travel, in which event the prospect's wife can be added to the list of prospective passengers. Once the wife has been induced to take her first air trip, the family objection is eliminated. To ascertain the source of objection to flying in any family or business and to supplant it with a motive of benefit to the family by using the airlines requires initiative and sales ability on the part of the traffic representative.

Importance of Contacts

In spite of the advancement made in communication and transportation, there still is a noticeable difference in the characteristics of persons residing in different parts of countries. For that reason it is advantageous that traffic representatives be selected in the vicinity where they are to be employed. Their contacts and acquaintances in their home city are valuable to them in their work, and to the company in securing business. A Californian is more valuable to his company on the Pacific coast than he would be in doing the same work in New York where it would be necessary for him to develop new contacts, learn eastern ways and methods of securing business.

Satisfied Customers

Increased passenger volume generates its own momentum to a certain extent. It is truly said that a satisfied customer and his word-of-mouth promotion are the most effective type of constructive advertising. More sales are made by satisfied customers than by the sales organization of any company. In this lies the absolute necessity of personal attention in assuring satisfaction to all passengers. To address the passenger by name and to make him feel that he is a special guest of the company develops his good-will toward the service being offered and adds to his enjoyment of the trip. Making it easy for passengers to make the acquaintance of more of the airline personnel on each successive trip, is certain to increase their personal interest in the company. Knowingly or unknowingly, they take pride in inducing friends and business associates to fly on the line whose pilots, hostesses, and other personnel they know by name.

An alert traffic representative never overlooks an opportunity to strengthen the good-will ties with these passengers.

He places their names on his mailing list to receive all announcements, pamphlets, booklets, time-tables, and other literature prepared by the company for general distribution. Frequently he presents his steady passengers with a new photograph of a transport plane or with some special souvenir prepared by the company for such patrons.

More care and effort should be exercised in developing a friendly relationship with travel agencies. These agencies have a complete coverage of those in their community who travel for business or for pleasure. They know how often and when "Mr. Jones" goes east each year on business and on what date each year "Mr. Smith" takes his family on vacation. These agencies have a coverage in their communities that is more complete and intimate than that of an airline. Too large a personnel would be required to develop such an accurate file of prospects and the agencies more often are patronized by the individual who prefers to do business with persons living in the same community.

Know Your Company

A traffic man must know his company in order to sell best the service operated. He should be familiar with the details of his company's operations, route, equipment, service and personnel. A good general knowledge of all of these subjects are his best equipment in selling his company's service. The first part of his education along these lines when he is employed should be a trip over the company's entire system. He should visit the airline's main base, witness the maintenance of the planes used by his company and meet the executives of the company. The president of many a company is known to employees in name only, and a mystery shrouds their imagination as to many of the names on the organization chart. Happily this condition does not apply to TWA.

TWA has tried to educate its traffic personnel by first acquainting it with what TWA has to sell and to equip properly the members of the traffic department with the information necessary for them to represent the company in a competent manner. A traffic representative trying to sell a ticket over a route he has never seen cannot effectively portray the advantages of using his company's line in preference to another. Such a representative soon finds that most of his prospects know more about his business than he does. They know of recent developments in the airline industry, new franchises granted and new services inaugurated. The handling of such passengers is not to be trusted to an agent ill equipped and only partially informed. If the same agent knows his company's route, service, equipment, and personnel in a complete manner and at the same time keeps himself informed on the activities of other airlines, invariably he will make his sale. Also, he will command the respect of the prospective passenger for himself as an efficient representative, and for the company employing such personnel.

Value of Photographs

Natural curiosity and the desire for greater knowledge on the part of all persons is a good reason why each traffic representative should use a volume of good photographs as a part of his sales equipment. A prospect who never has flown has had no occasion to learn of the mechanical care given airline planes and engines. As an automobile owner, he has developed the habit of depending on mechanical functioning, securing repair or service only when mechanical difficulty is experienced. Several excellent photographs showing the maintenance procedure employed by the airline attract the interest of the prospective customer in this subject and provides an opportunity for the traffic representative to explain that periodic maintenance is given all engines and planes used by his company. Pictures of prominent persons using the line instill confidence. Interior views emphasizing spaciousness and comfort promote the thought of luxury in travel. In all, the prospective passenger's interest is absorbed in the photographs, which, besides providing the traffic man with an opening for sales conversation on each subject illustrated, do considerable toward educating the prospective passenger to air travel.

If this is the case, then a substantial part of the traffic representative's job is an educational one and he must be equipped to "instruct" intelligently, thereby confirming the fact that he must know his company and what it represents.

Selecting prospects is not a matter of cold canvass but an organized system. No representative should confine his sales efforts to one group of selected prospects as many classes are prospects for future travel or an unofficial envoy who could be instrumental in helping to sell others. Chambers of commerce, civic bodies, business organizations, trade groups, and clubs are fertile fields for prospective air travelers. Business leaders are active civic leaders and take part in chamber of commerce functions. They can be reached en masse by interesting and instructive talks at these meetings. Such talks provide an excellent opportunity for a more receptive introduction to the members than by calling at their offices. Once their acquaintance has been made by the more informal means of club meetings, follow-up visits to their offices receive a more cordial welcome.

Airline operations now are at their highest peak. It is necessary that the airline traffic departments do more than just keep pace with operations. With such extensive operations and the use of present efficient equipment, the matter of increasing schedules and service is one that needs only the demand for more seat miles. It is the responsibility of the traffic department to create and maintain a demand above the scope of operation. By keeping the demand at a pace ahead of the supply, airline traffic volume will continue to grow at a satisfactory rate.

At airline ticket offices, passengers are attended by capable and well-informed representatives

Asphalt Surfaces for Airports

BERNARD E. GRAY

Chief Highway Engineer, The Asphalt Institute

● The proper layout of a large airport is an art in itself and one best handled by airport engineers. However it is desirable to stress the importance of having a definite plan as to ultimate development prior to undertaking any work. Too frequently an airport has been started with one runway, located only with view to low first cost, and then abandoned because it did not fit in with expansion needs.

The importance of high subgrade values is immediately apparent and, having a proper layout, the first essential step is grading and drainage. Regardless of surface type, drainage should be as nearly perfect as possible and, if there is any question as to division of funds, it always should be resolved in favor of a dry subgrade. It is more advantageous to have a completely drained runway, with an oiled gravel wearing course, than a high type of pavement with poor drainage. In the latter case it is only a question of time before subgrade resistance will be lowered from entry of water, and rapid surface deterioration will occur. In the first instance the well drained earth grade affords a sound foundation to which increased surface thickness may be added as warranted by increasing traffic. The use of corrugated iron pipe for runway drainage, including the new perforated types has much to commend it.

Notwithstanding the wide utilization of asphalt surfaces in and around airports, there is some misconception as to their proper design, especially in runways. This has resulted, in numerous instances, in overbuilding and unnecessary expense. The maximum load upon a runway is static, impact forces being small. For purposes of pavement design for determining the thickness of structure, a value of 1.5 times static load may be used for W in the formula

$$t = .564 \times \sqrt{W/S} - e \; .... (1)$$

in which

$$W = \pi r^2 S$$

and from the large 45° triangle in the accompanying diagram

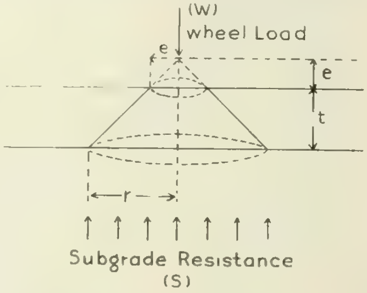
$$r = t + e$$

therefore

$$W = \pi (t + e)^2 S \; .... (2)$$

Solving for t, the thickness of structure can be obtained from (1) where

t = thickness of pavement (in.)
W = wheel load (lbs.)
r = radius of circle of load distribution
πr^2 = area of circle of load distribution
S = subgrade resistance (lbs./in.^{2})



Using a value of 1.5 times static load and with the other factors, an adequate margin of safety will be provided.

Loads upon an airport have been compared to those upon a highway, but this is not an entirely true analogy, except that where surfaces are smooth there is little or no impact in either case. Repetition of load upon a runway is less frequent than upon a secondary highway, and the question of fatigue needs no consideration with asphalt surfaces. On the other hand, because of the lack of frequent traffic, softer asphalts and somewhat richer mixtures are desirable where maximum durability is required.

The maximum load upon a runway is the static load. During the take-off run, the wing lift quickly reduces the load upon the tires and, soon after starting, this load has diminished markedly. In landing, two forces are acting—gravity and forward momentum. The resultant of these is so nearly parallel to the surface that a relatively thin pavement with the proper subgrade has all the resistance required. The impact upon the plane when landing is another matter and, while no satisfactory method of measuring this force has yet been developed, it is estimated that it may be as much as 3.5 times the static load. The vertical downward movement of a hard surface runway under impact, however, as compared to the vertical movement of the tire and shock absorber, is so small as to be of little consequence. It is necessary to distinguish clearly between these different reactions.

The various types of surfaces commonly used for highways are equally well adapted for runways, and selection should be so made that, if traffic increases, the addition of a relatively thin surface will keep the field entirely adequate for the heavier loadings.

When properly laid out, runways also

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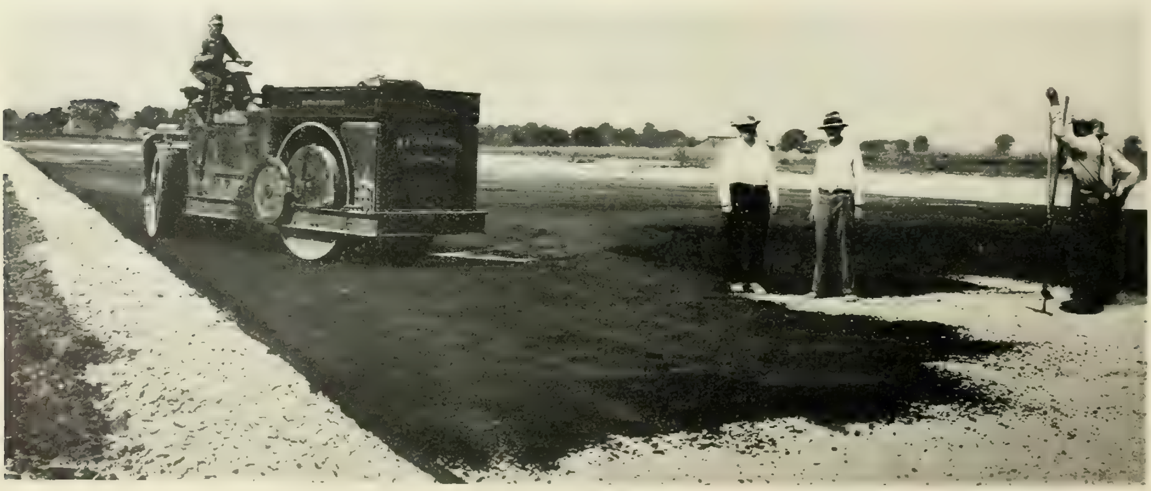
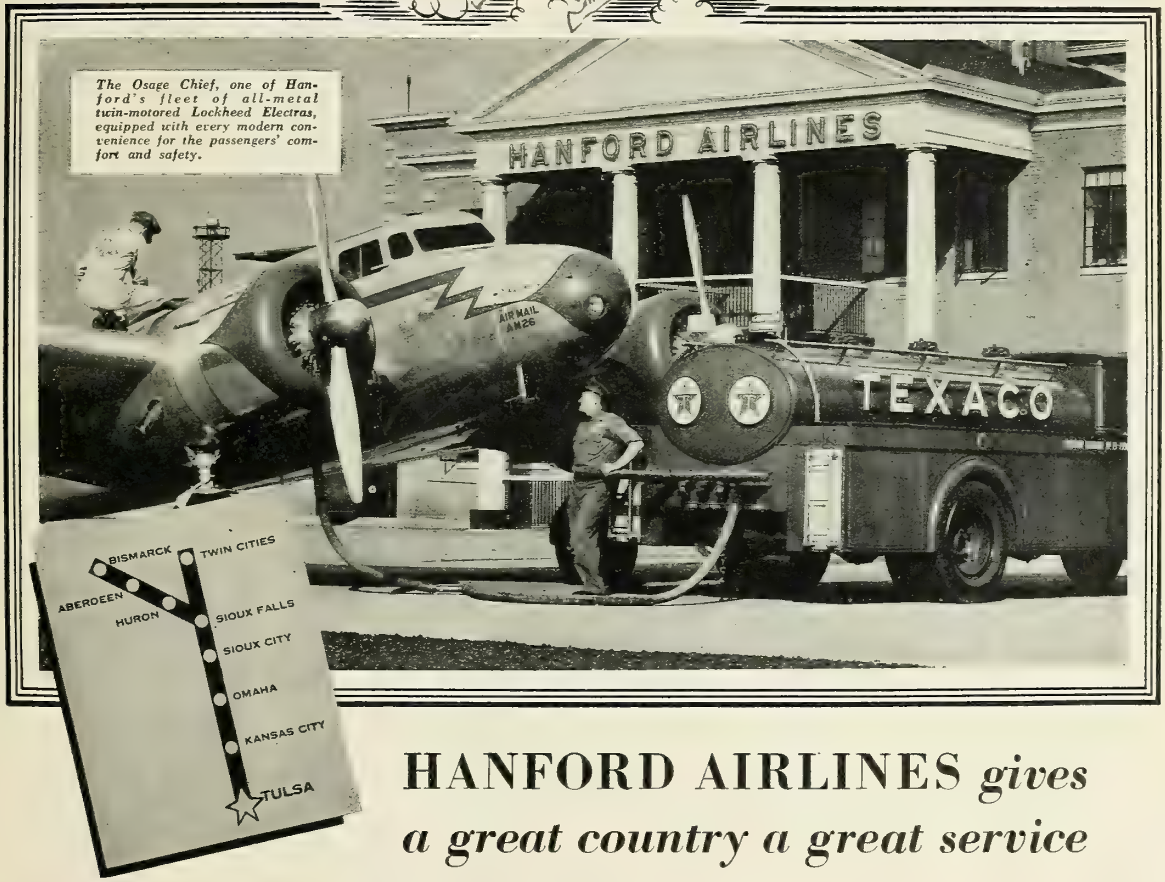
Placing an asphalt concrete base on macadam sub-base



Trails of the Indian Chiefs



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(Left): Applying liquid asphalt for mixed-in-place surface. (Right): Typical asphalt macadam apron. (Below): Earth-stone cut-back-oil mix with a seal coat of cut-back asphalt and limestone chips to give high visibility

(Continued from preceding page)

serve to organize and regulate air traffic operations. It is therefore desirable that these surfaces be clearly defined and distinguishable from the rest of the field, both during the day and at night, and this condition is best obtained by giving a seal coat to the completed asphalt surface (regardless of type) and then covering with a light colored aggregate. This is particularly desirable where the entire field has been given a dust layer treatment of asphaltic oil and tends to have a uniformly dark color. It is possible to obtain a completely white surface if this is desired.

All loose material should be eliminated from the surface. In finishing operations the final seal coat, or final compaction in the case of plant mix surfaces, should be accomplished so that all aggregate particles are either firmly imbedded or else swept away, so that they will not be thrown about by the propeller blast.

For the majority of small airports the initial surface may be most economically made by stabilizing the subgrade, placing a foundation of cinders, gravel, rock or slag and then giving a surface treatment according to Asphalt Institute Specification S-2 or S-3, or placing a road-mix surface course according to Specification R.M-1 or R.M-2.*

Specification S-2 applies to a treatment intended for application to tightly bonded surfaces including waterbound macadam, clay gravel, sand clay, shale, lime-rock and similar types. In this method, the existing surface is first brought to a uniform contour by patching all depressions and defective areas over ¾ in. in depth, and eliminating bumps or similar irregularities. The prepared surface is treated with an asphalt primer, then a treatment of cut-back asphalt is applied and covered with mineral aggregate which is spread, broomed and then rolled.

Specification S-3 is for loosely bonded surfaces, the treatment calling for scarifying and blading the surface to a uniform contour, then treating it with a heavy asphalt primer, and then covering with mineral aggregate after which a second application of the same material used for priming is made. The surface is bladed or dragged until all aggregate particles are thoroughly coated, and it is then consolidated by rolling.

Specification R.M-1 is intended for an asphalt road mix surface of the macadam aggregate type consisting of mineral aggregate and cut-back asphalt binder combined. It is laid to a finished thickness of not less than 2 in. upon a prepared base of suitable thickness and width previously treated with an asphalt primer. In construction, the base is first treated with an asphalt primer, then a layer of coarse aggregate is spread over the primed surface in sufficient quantity to produce a compressed wearing course of the specified thickness. The coarse aggregate is treated and mixed-in place with cut-back asphalt after which it is thoroughly rolled. A seal coat of cut-back asphalt is then applied and covered with a fine aggregate.

In R.M-2, which is for the dense graded aggregate type, the course consists of finer particles than in R.M-1, and is laid to a thickness of 1 to 4 in. The base course is first treated with an asphaltic primer. A layer of graded aggregate is spread over it sufficient to produce a compressed wearing course of specified thickness. The graded aggregate is treated and mixed-in place with cut-back asphalt binder, spread and compacted by traffic during blading and dragging, and rolled. A seal coat of cut-back asphalt is applied to the compacted wearing course and it is then covered with fine aggregate.

Probably S-3 or R.M-2 will best fit the majority of cases, because by these methods opportunity is afforded to use a wide variety of loamy soils in place, after modification by admixture of some granular aggregate. The asphaltic material is of the medium curing type, and thus takes care of any dusty situation without difficulty. A final seal coat with fine aggregate cover should be given always so as to provide an absolutely waterproof surface, and thus insure long life. For such surfaces, sand should be used for the cover aggregate.

Where hard stone or slag is available, asphalt macadam makes an excellent runway surface. However the cover aggregate over the final seal coat should be somewhat smaller (¾" × ⅛") than for highway surfaces, as a dense closed surface texture is to be preferred. The advantage in the use of this type is the presence of relatively thick films of asphalt cement of relatively soft consistency (100-150 pen.) so that cracking and drying out of such surfaces even under light traffic practically never occurs.

For heavy traffic runways, either asphalt macadam or plant-mix surfaces are to be preferred. In the use of the latter types some modification is desirable as compared with highways. A softer asphalt cement, a greater quantity of it and some reduction in filler are recommended. A mix stability of 1000 lbs. is adequate for any runway surface, and the mixture should be designed with this limit in view. Even with plant mix surfaces, it is usually desirable to place a light seal coat of liquid asphalt covered with sand, for reasons above outlined.

Taxiways as a rule should be of the same type surface as the runways, for economy in both construction and maintenance. Aprons should be surfaced with a dense and durable surface. Sheet asphalt, asphaltic concrete or asphalt block are excellent for such locations, the latter be-

(Continued on page 102)

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* Copies of these construction specifications can be obtained, without charge, from the Asphalt Institute, 801 Second Ave., N. Y., N. Y.

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Results of the Air Races

● The 1936 National Air Races were especially rich in new engineering design features, for in addition to the Caudron-Renault racer which is described in another article in this issue, there was the Folkerts Special flown by Harold Neumann, the Keith Reider racers flown by Roger Don Rae and David Elmendorf and the Crosby Special flown by Harry Crosby.

The Folkerts Special is a cantilever mid-wing monoplane powered by a 150 hp Menasco C4S *Pirate* engine which gives it an estimated maximum speed of 240 mph. Structure of the fuselage is steel tubing while the wing is of monospar construction with spruce I beams and plywood covering. The Reider Racers flown by Rae and Elmendorf are low-wing cantilever monoplanes with retractable landing gear and wing flaps. Power is furnished by Menasco B6S *Buccaneer* engines which gave the Rae plane a maximum speed of 270 mph, and the Elmendorf plane 260 mph. Fuselage construction is of steel tubing, and the wing is of the monospar type with plywood covering. Crosby's Menasco *Super-Buccaneer* powered plane was the only all-metal racer at the meet. Of low-wing design it is chiefly characterized by stubby wings and a long slender fuselage. Unfortunately it was not entirely finished in time and was flown without a cockpit enclosure, a spinner on the propeller and without the proper cowling.

Advancement in speed plane construction and engine design brought about the creation of new speed records in three of the major closed course races. Michel Detroyat who flew the French Caudron C-460 Renault powered racer broke the Thompson and Greve trophy race marks by flying 264.261 and 247.3 mph respectively, bettering the first by about 12 mph and the second by 34 mph. Newmann took the 375 cu. in displacement race for the Shell Trophy at 231.344 mph which was about 30 mph faster than the best previous mark for the event.

The Bendix Transcontinental free-for-all race was won by Louise Thaden. While 1936 was the first time that women entered this event, they set up a notable record inasmuch as they placed three among the first five to finish. In addition to winning the Bendix Trophy and $4500 for her accomplishment, Mrs. Thaden, who flew a 450 hp Wright Whirlwind powered Beechcraft and was accompanied by Blanche Noyes, received $2500 more for setting up a new official feminine east-to-west transcontinental speed record of 14 hours 55 minutes 1 second, exceeding by almost four hours the record held by Laura Ingalls. Miss Ingalls came in second, W. Gulick in a Vultee was third, George Pomeroy in a Douglas was fourth and Amelia Earhart in her new Lockheed Electra finished fifth.

Although Roscoe Turner, Benny Howard and Joe Jacobson were also entered in the Bendix Race, they were not among the finishers. Turner met mishap on the way east for the start of the race and wrecked his Wedell-Williams racer. Howard and Mrs. Howard crashed in New Mexico while they were leading the Bendix racers and Jacobson had to parachute his way to safety when mechanical difficulties made his racer unmanageable.

The closed course races were interesting because of the close competition between Neumann and Art Chester, who flew one-two in the Shell Trophy and Shell Award events, and finished runner-

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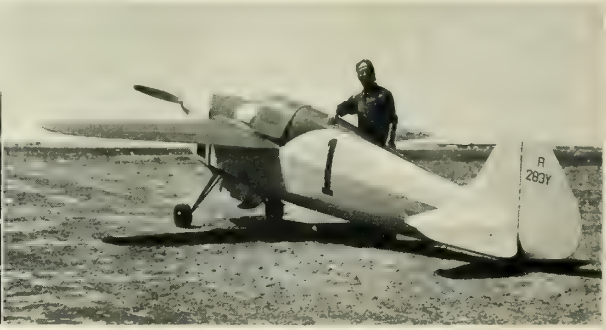
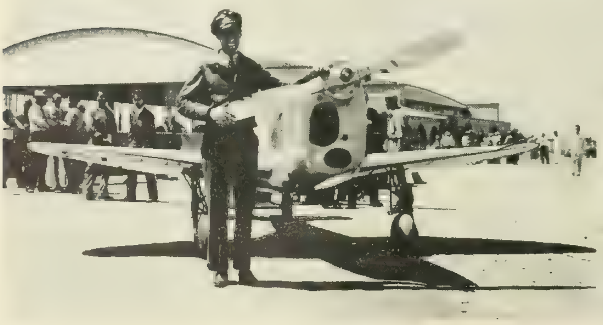
Michel Detroyat and the Renault-Caudron



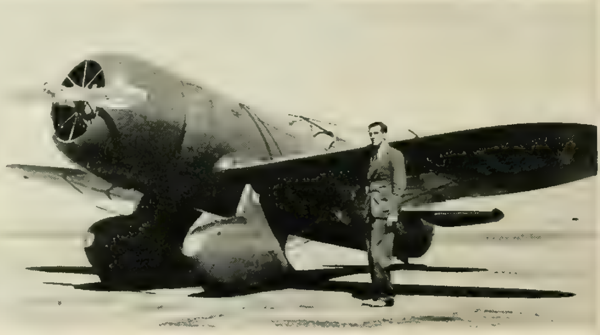
Harold Neumann and the Folkerts Special

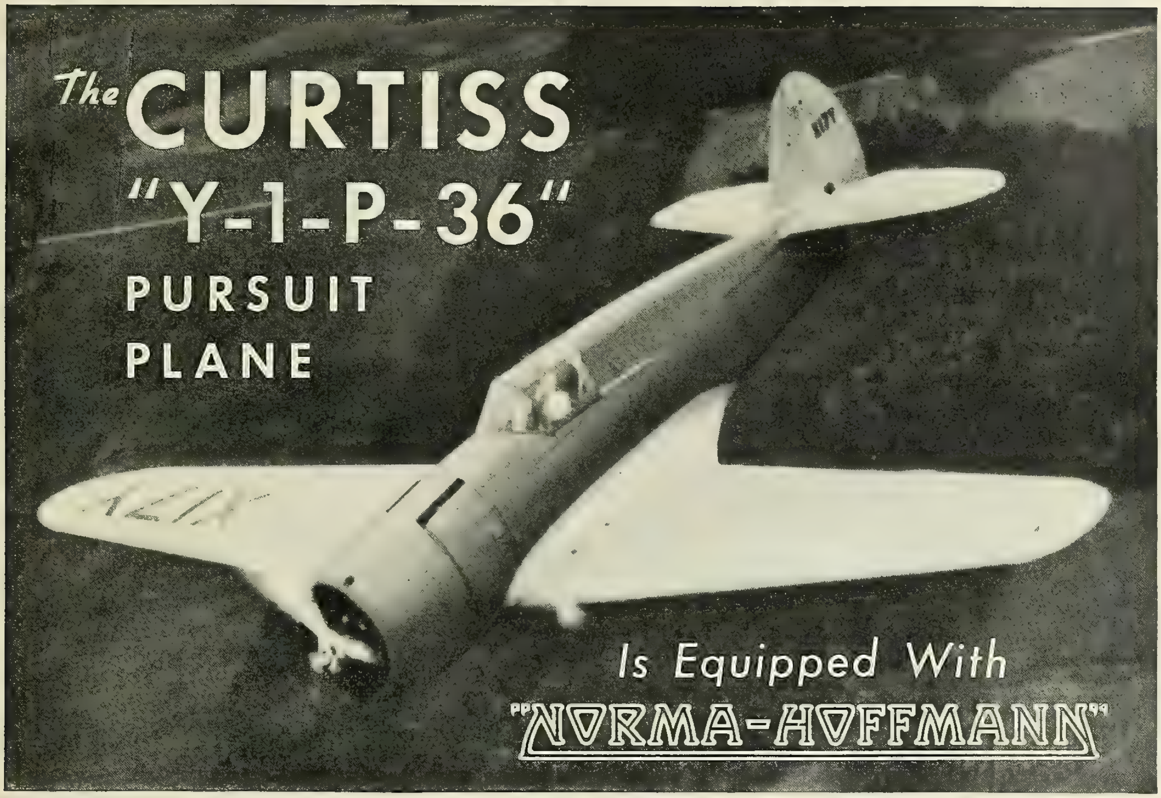
Photographs by Dick Whittington

Harry Crosby and the Crosby Racer



Lee Miles and the Gee Bee "Q.E.D."





PRECISION BEARINGS

The illustration shows the high-performance, single-seated pursuit plane of low-wing monoplane construction as built for the Army Air Corps by Curtiss Aeroplane and Motor Co., Inc., Buffalo, N. Y.—one of the many builders of aircraft and aircraft equipment who employ NORMA-HOFFMANN PRECISION BEARINGS.

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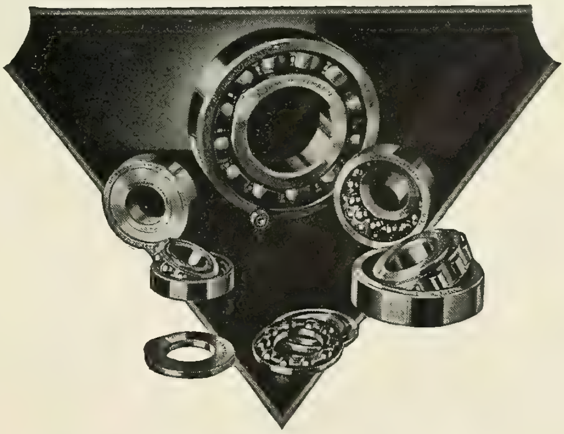

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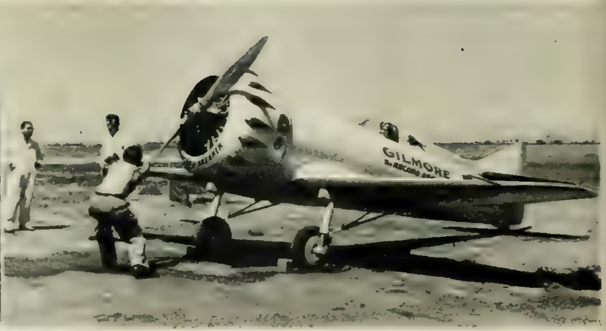
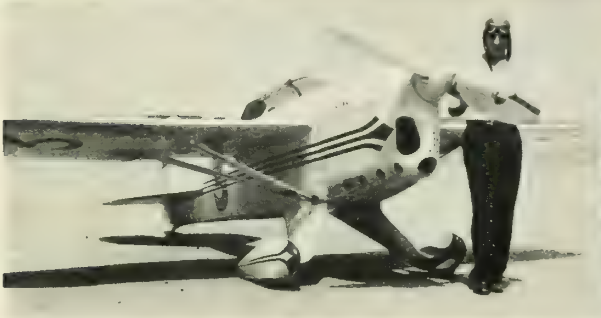
Marion McKeen and the Brown B2


Earl Ortman and the Wasp-powered Reider

Photographs by Dick Whittington


Art Chester and the Chester Special

Roger Don Rae and the Reider Racer

(Continued from preceding page)

up and third, respectively, to Detroyat in the Greve race.

Even before the Thompson Trophy Race, it was conceded that Detroyat would win the American speed classic. Flying in the speed qualifying trials, he reached 273.473 mph which was better than the best previous time ever recorded in the Thompson race. The field lined up with six racers at the starting line, including Detroyat, Rae, Neumann, Crosby, Marion McKeen in a Menasco-powered Brown B2 and Earl Ortman in a Wasp Jr.-powered Reider Racer.

Besides the Bendix transcontinental, and the closed course events, the races were featured by the stunt and acrobatic flying of some of the world's foremost exponents of the art. Giving aerial demonstrations were Major Al Williams, Aviation Manager of the Gulf Company, Milo Burcham, Harold Johnson, Gerd Achgelis of Germany, Alex Papana of Roumania, Dick Granere of Canada, and the U. S. Army Air Corps Sextet from Barksdale Field.

Army, Navy and Marine representation was included, the 17th Attack Group from March Field, and special contingents from the San Diego Naval Air Station representing the military services.

The crowd on the opening day witnessed the arrival of the 36 ships which participated in the Ruth Chatterton Derby from Cleveland to Los Angeles. Harry Spreckles won the race and George Armistead took top honors for the Dallas-Los Angeles division.

The entry of a foreign competitor in the Thompson Trophy Race and his victory in both the Thompson and Greve events for the first time in the history of American air racing, has done much to stimulate developments along racing lines.

Pilot	Airplane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Elapsed Time	Money
Event 1. Bendix Trophy Race						
Louise Thaden	Beechcraft	Wright	...	...	14:55.01	$7,000
Laura Ingalls	Lockheed	Wasp	...	...	15:39.38	2,500
W. Gulick	Vultee	Wright	...	...	15:45.25	1,500
Geo. Pomeroy	Douglas	Wright	...	...	16:16.51	1,000
Amelia Earhart	Lockheed	Wasp	...	...	16:34.53	500
Ruth Chatterton Sportsman Pilot Trophy Race						
Frank Spreckles	Luscombe	Warner	499	...	.	...
Jeanette Lempke	Davis	Warner	422	...	...	...
Jerry Fairbanks	Stinson	Wasp Jr.	985	...	...	...
George Armistead	Stinson	Lycoming	680	.	. .	.
George Arents	Fairchild	Warner	756	. .	.	.
Event 3. Women's A.T.C. Race, 800 Cu. In. Displacement						
Betty Browing	Cessna	Warner	499	...	15:58.62	675
Gladys O'Donnell	Ryan	Menasco	363	...	16:10.01	375
Genevieve Savage	Ryan	Menasco	363	...	16:27.25	225
Jeanette Lempke	Davis	Warner	422	...	16:30.94	150
Nancy Love	Beechcraft	Jacobs	755	. .	16:44.06	75
Event 4. Shell Trophy Race, 375 Cu. In. Displacement						
Harold Neumann	Folkerts	Menasco	363	223.201		3,000
Art Chester	Chester Spl.	Menasco	363	222.235	. .	1,250
Lee Miles	M & A Spl.	Menasco	363	202.848	...	700
Joe Jacobson	Howard	Gypsy	318	147.424	...	450

Pilot	Airplane	Engine	Cu. In. Displ.	Speed (m.p.h.)	Prize Money
Event 6. Shell Award, 375 Cu. In. Displacement					
Harold Neumann	Folkerts	Menasco	363	231.344	$1,350
Art Chester	Chester Spl.	Menasco	363	230.479	750
Joe Jacobson	Howard	Gypsy	318	147.565	450
Event 7. Greve Trophy Race, 550 Cu. In. Displacement					
Michel Detroyat	Caudron	Renault	488	247.300	4.900
Harold Neumann	Folkerts	Menasco	363	225.858	2,125
Art Chester	Chester Spl.	Menasco	363	224.682	1,190
R. A. Kling	Keith-Reider	Menasco	544	218.331	765
Joe Jacobson	Howard	Menasco	489	214.426	595
Roger Don Rae	Reider Racer	Menasco	488	212.325	425
Event 9. Shell Cup Race, 550 Cu. In. Displacement					
Roger Don Rae	Reider Racer	Menasco	488	225.544	1,350
Harold Neumann	Folkerts	Menasco	363	223.561	750
Marion McKeen	Brown B2	Menasco	544	218.808	450
Lee Miles	M & A Spl.	Menasco	363	206.188	300
David Elmendorf	Elmendorf Sp.	Menasco	363	......	150
Event 10. Thompson Trophy Race					
Michel Detroyat	Caudron	Renault	488	264.261	9,500
Earl Ortman	Reider	Wasp Jr.	1344	248,042	4,375
Roger Don Rae	Reider Racer	Menasco	488	236.559	2,450
Harold Neumann	Folkerts	Menasco	363	233.074	1,575
Marion McKeen	Brown B2	Menasco	544	230.465	1.225
Harry Crosby	Crosby	Menasco	544	226.075	875

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MARTIN EXPORT BOMBER

The Martin Export Bomber (Model 139-W) powered by the new 1000 H. P. Wright Cyclone engines, is one of the world's outstanding bombardment planes—with a high speed up to 240 miles per hour, a service ceiling of 29,000 feet and a landing speed of 65 miles per hour.

For the past two years the Martin B-10-B Bomber has been the standard, heavy-duty bombardment plane of the U. S. Army Air Corps. More than one hundred Martin Bombers, powered by Wright Cyclones, have been purchased by the U. S. Army Air Corps.

The new 1000 H. P. Wright Cyclones installed in the Martin Export Bomber are the same type as the Cyclones installed in the twin-engined Douglas Bombers and the four-engined Boeing Bombers—the latest heavy-duty bombardment planes of the U. S. Army Air Corps.

In the commercial field, 1000 H. P. Cyclones power the fleet of huge Douglas DC-3 transports now in service on American Airlines. Similar transports have also been ordered by Eastern Air Lines and KLM (Royal Dutch Airlines).

WRIGHT AIRCRAFT ENGINES

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WRIGHT AIRCRAFT ENGINES

Italian air strategy and policy in the Mediterranean area as well as the new program of renovation and expansion of the military and naval air forces are covered in Part I of this article. Single and two seat fighters, reconnaissance and observation planes. Naval fighters and observation seaplanes are briefly described in a digest of types, constructional features, armament, and performances. Part II, scheduled for the November issue of AERO DIGEST, will describe the various types of light and heavy bombers, patrol planes, flying boats, and other miscellaneous naval aircraft now in active service.

The 140 hp Breda 39S has a high speed of 140 miles per hour

Italian Military Aircraft

(Part 1)

PEYTON M. MAGRUDER

● It is obvious that Mussolini is determined to control the Mediterranean, and this he can do only through the medium of the Italian air force. As a result, in the rearmament race that is going on all over the world, Italy is devoting chief attention to her air strength for she is firmly convinced that whoever is supreme in the air will be supreme also on earth.

A plan is now under way to renovate Italy's entire aerial fleet. In its original form this was to have been completed in six years, but early last year it was announced that the time had been reduced to three years.

Since then there has been a further speeding up with the result that by the end of this year the equipment of the Italian Air Force will be to a large degree modern and efficient and will compare favorably with that of France and Great Britain.

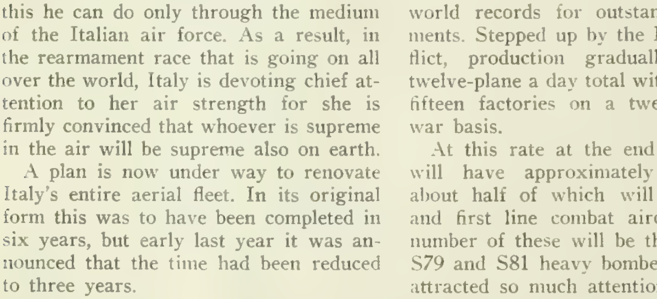
Before the renovation program was put into effect Italy had about 3000 planes of all types and descriptions. A large portion of these were rapidly nearing obsolescence; a few were in fair condition; and still others (a definite minority) held world records for outstanding achievements. Stepped up by the Ethiopian conflict, production gradually reached a twelve-plane a day total with all of Italy's fifteen factories on a twenty-four hour war basis.

At this rate at the end of 1936 Italy will have approximately 5000 planes about half of which will be up-to-date and first line combat aircraft. A great number of these will be the new Savoia S79 and S81 heavy bombers which have attracted so much attention in the Ethiopian campaign and in Spain.

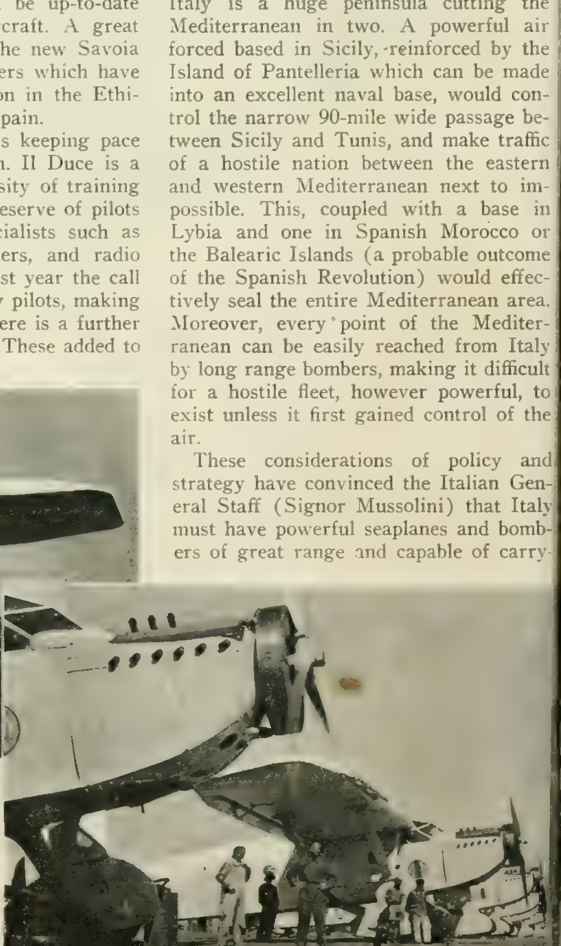
Progress in personnel is keeping pace with the new construction. Il Duce is a firm believer in the necessity of training and *maintaining* a large reserve of pilots as well as air force specialists such as engineers, mechanics, fitters, and radio operators. Twice in the last year the call has gone out for 1500 new pilots, making 3000 in all. At present, there is a further call for 15,200 specialists. These added to the regular pilot (officer personnel) force of 3000 and enlisted force of 30,000 give Italy one of the largest military air organizations in the world. New airports, both civil and military, are springing up all over the country.

When Italy's air program is completed, the Italians justly believe that they will be masters of the Mediterranean. It is sufficient to glance at a map to see why. Italy is a huge peninsula cutting the Mediterranean in two. A powerful air forced based in Sicily, reinforced by the Island of Pantelleria which can be made into an excellent naval base, would control the narrow 90-mile wide passage between Sicily and Tunis, and make traffic of a hostile nation between the eastern and western Mediterranean next to impossible. This, coupled with a base in Lybia and one in Spanish Morocco or the Balearic Islands (a probable outcome of the Spanish Revolution) would effectively seal the entire Mediterranean area. Moreover, every point of the Mediterranean can be easily reached from Italy by long range bombers, making it difficult for a hostile fleet, however powerful, to exist unless it first gained control of the air.

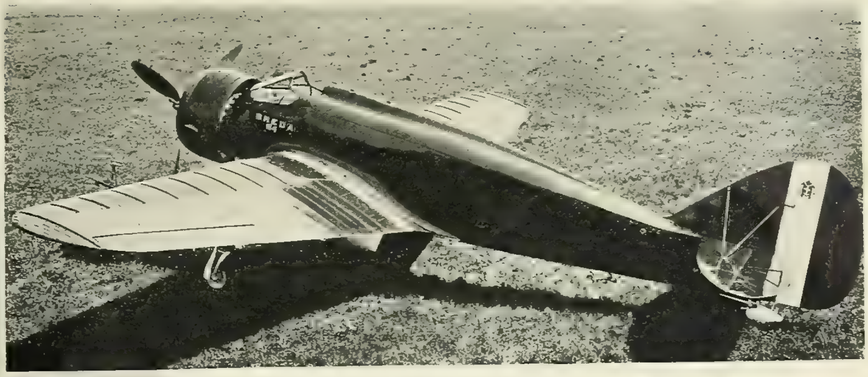
These considerations of policy and strategy have convinced the Italian General Staff (Signor Mussolini) that Italy must have powerful seaplanes and bombers of great range and capable of carry-



Caproni 111 single engine 830-970 hp light bomber and observation plane



The Breda 64 one of Italy's latest single-seat fighters to be placed in quantity production



The Breda 64 has an all-metal fuselage protected below the pilot's cockpit with a light steel armor

ing heavy bomb loads. The problem of defence of Italian industrial centers which are not concentrated but are strung out for miles along the coast has necessitated the development of fighters remarkably similar to those of the United States.

Italian fighters are with few exceptions single place ships of the monoplane type utilizing to a large extent radial engines ranging from 675 to 700 hp and having gross weights averaging 4500 lbs. with useful loads of from 1100 to 1500 lbs. Top speeds are uniformly above 200 and to a great extent exceed 245 mph.

Fighters

The Bergameschi (Caproni subsidiary) *A.P. 1,* a low-wing, single seat fighter is similar in appearance but inferior in performance to the Boeing P-26. The one-piece cantilever wing is of wooden structure covered with plywood and fabric while the fuselage is of welded steel tube framework. A 600 hp Piaggio Stella IX RC 9-cylinder radial air-cooled, geared and supercharged engine gives a maximum speed of 196 mph at 15,000 ft. With a gross weight of 5,126 lbs., absolute ceiling is 24,600 ft. and rate of climb (at rated altitude) is 1,600 ft./min. Three machine guns are carried, 2 of which are placed in the landing gear firing outside of the propeller disc, and the other mounted in the fuselage firing ahead.

The Breda 27, another copy of the P-26 along more exact lines, is a low-wing, metal-and-fabric covered monoplane. Fuselage structure is of welded steel tubing of oval section covered with light dural panels. The wing is externally braced with short stubs built integral to the fuselage and rigidly cross braced to the landing gear (of the divided type) with high-tensile steel tie rods. An Alfa-Romeo *Mercury VI* 9-cylinder radial air-cooled, geared, and supercharged engine, equipped with a 3-bladed propeller, delivers 620 hp and gives a maximum speed of 248 mph at 16,400 ft. Time to climb to 20,000 ft. is slightly less than ten minutes and maximum ceiling is 32,800 ft. Two Breda 7.7 or 12.7 calibre machine guns are mounted in the fuselage and 400 rounds of ammunition are carried for each gun. Provision for lighting and heating, oxygen equipment, and two-way radio are standard for this fighter which has been delivered in large quantities within the past eighteen months.

The Breda 64 is one of the latest single-seat fighters to be placed in quantity production. It incorporates a number of unusual features which make it outstanding among Italian fighters of its type. Of all-metal structure, the fuselage is of standard welded chrome-molbydenum steel tube framework covered with duralumin panels. Below the pilots' cockpit is a light but resistant steel armouring which will deflect .30 calibre bullets. The cantilever wing is in three sections: a central portion rigidly incorporated in the fuselage, with two wing roots, carrying the wide retractable landing gear, to which are attached the two outer wing panels. Wing structure is of medium thick section, consisting of two chrome-molybdenum tube spars interconnected by diagonal steel members both in the upper and lower planes of the spars. Ribs are closely placed, the whole being covered with dural sheet riveted to the spar flanges and to the ribs. The fuel tank is provided with *Semape* protection against gasoline leaks and inflammation. The most unusual feature of the Breda 64 is its armament which consists of five machine guns. Four are placed in the wings and are controllable by the pilot through 12° vertically. These guns, of 7.7 mm calibre, are loaded and cocked pneumatically. The fifth gun mounted on a ring in the cockpit is traversed through 120° (horizontally) by a hydraulic gear and may be retracted entirely by a mechanical control. Two hundred 2.2 lb. bombs are

Caproni 101 tri-motored planes used in the Ethiopian campaign normally carried inside the fuselage in addition to other standard equipment such as oxygen, cameras, telescopic and bomb sights. With a safe load factor of 10.5 this fighter has a normal useful load of 1980 lbs. which may safely be increased to 2420 lbs. Power is supplied by a 700 hp Alfa-Romeo *Pegasus* engine, giving a top speed of 220 mph and an absolute ceiling of 24,000 ft.

The Caproni 114, a single bay, equal span, staggered biplane single or two seat fighter, is of conventional design and appearance. Equipped with a 420 hp Bristol *Mercury IV* radial, top speed is 220 mph at 16,400 ft., range 375 miles, and absolute ceiling 31,160 ft. An unusual feature is the Garelli compressed air starter.

The Caproni C.H. 1 is an equal span, single bay biplane similar in appearance to the American Gee Bee racer although lacking its deep fuselage. Wings and fuselage are of steel structure, fabric and dural covered. Ailerons are placed on all four wings giving a high rate of roll and excellent maneuverability. The power plant is a 780 hp Gnôme-Rhône 14 Kfs radial supercharged engine which gives a maximum speed of 273 mph at 16,000 ft. with a three-bladed controllable pitch propeller. Fully loaded the C.H. 1 weighs 4620 lbs. and climbs to 16,400 ft. in less than 5 minutes. Armament consists of two fixed guns firing forward through the propeller disc. Unusual features are the compressed air brakes and engine starting equipment. This fighter is the fastest now in actual service in the Italian air force.

The Fiat C.R. 32 is a single seat sesquiplane fighter equipped with a Fiat A 30 RA 12-cylinder V water-cooled engine rated 550 hp at 10,000 ft. Fuselage is of rectangular shape, of light alloy tubing with steel fittings, faired with dural formers and stringers, the whole fabric-covered. Wings are of light alloy and steel structure covered with fabric and interconnected by Warren type interplane struts. Top speed is 242 mph, range 500 miles, absolute ceiling 29,000 ft., and climb to 20,000 ft. requires 11 minutes. Gross weight is 3960 lbs.

PRINCIPAL ITALIAN MILITARY AIRPLANES

Type	Total hp	Gross Weight (lbs)	Maximum Speed (mph)
FIGHTERS			
Bergameschi A.P. I	600	5126	196
Breda 27	620	3938	248
Breda 64	700	5450	224
Caproni 114	420	3080	220
Caproni C.H. I	780	4620	273
Fiat C.R. 32	550	3960	242
Fiat C.R. 33	700	4275	256
Fiat C.R. 40	780	4325	236
Romeo Ro. 37	550	4650	225
Romeo Ro. 41	430	4120	220
OBSERVATION OR RECONNAISSANCE			
Caproni 111	830/970	12100	180
Romeo Ro. 30	530	5830	155
Breda 39 S	140	2062	140
SEAPLANE FIGHTERS AND LIGHT OBSERVATION			
C.M.A.S.A. M.F.6	450	4807	161
Cant 25 A.R.	400	3753	152
Romeo Ro. 43	700	4400	215
Piaggio P-10	450	6100	160

The Fiat C.R. 33 and the C.R. 40, modifications of the C.R. 32, incorporate newer and more powerful engines. The C.R. 33 equipped with a Fiat A 33 engine has a maximum speed of 256 mph while the C.R. 40 with a 14Kfs Gnôme-Rhône of 780 hp has a 236 mph top speed. In the latter type the upper wing has been lowered, but other characteristics are kept the same.

Two new and experimental fighters are the Romeo Ro. 37 and the Ro. 41. The former is a two-seat fighter-observation biplane fitted with a Fiat A30 RA in-line V 12 cylinder engine of 550 hp and has a maximum speed of 225 mph. The Ro. 41 is a single seat gull wing sesquiplane with the 430 hp Piaggio *Stella VII C.2* engine. Similar in appearance to the French Loire 46 fighter (a monoplane), the Ro. 41 has an estimated top speed of 220 mph.

Reconnaissance and Observation Types

There are only two outstanding types of reconnaissance or observation land planes in use today in the Italian Air Force—the Caproni 111 and the Romeo Ro. 30 both of which have been standard equipment since 1932 although they have been considerably improved and modified in the past four years.

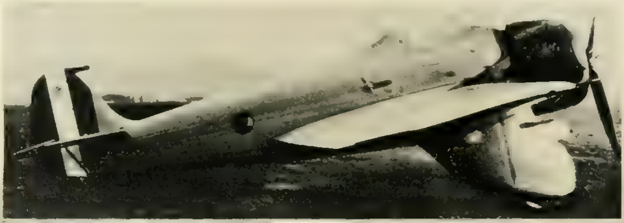
The Caproni 111, an enlarged version of the Ca. 101 night bomber, is a high wing light bomber and observation type closely following the familiar Bellanca method of construction and design. Fuselage is of steel tubular framework and the monoplane wing is almost entirely wooden. An Isotta-Fraschini 18-cylinder W water-cooled supercharged *Asso-750 RC* engine of 830-970 hp gives a maximum speed of 180 mph, a range of 807 miles, and an absolute ceiling of 23,000 ft. Empty the Ca. 111 weighs 7700 pounds and fully loaded 12,100 pounds. Both pilot and observer have unusually good visibility. Equipment includes three machine guns, one of which is an enclosed turret on top of the fuselage aft of the wings.

The Ro. 30, a 3-seat reconnaissance and army cooperation biplane is of sesquiplane design. General structural features are similar to the Ca. 111, wings being of all-wood construction and the fuselage of welded tubular framework covered with duralumin sheet and fabric. A 530 hp Alfa-Romeo *Mercury* air-cooled radial geared and supercharged engine gives a top speed of 155 mph, a range of 994 miles, and an absolute ceiling of 27,000 ft. Empty weight is 3520 lbs. and fully loaded 5830 lbs. Armament consists of a fixed gun forward and 2 guns in a turret aft and above the cabin.

An unusually light two-seat experimental observation type is the Breda 39 S converted from the Breda 39, a sport plane of unique design. The slotted and

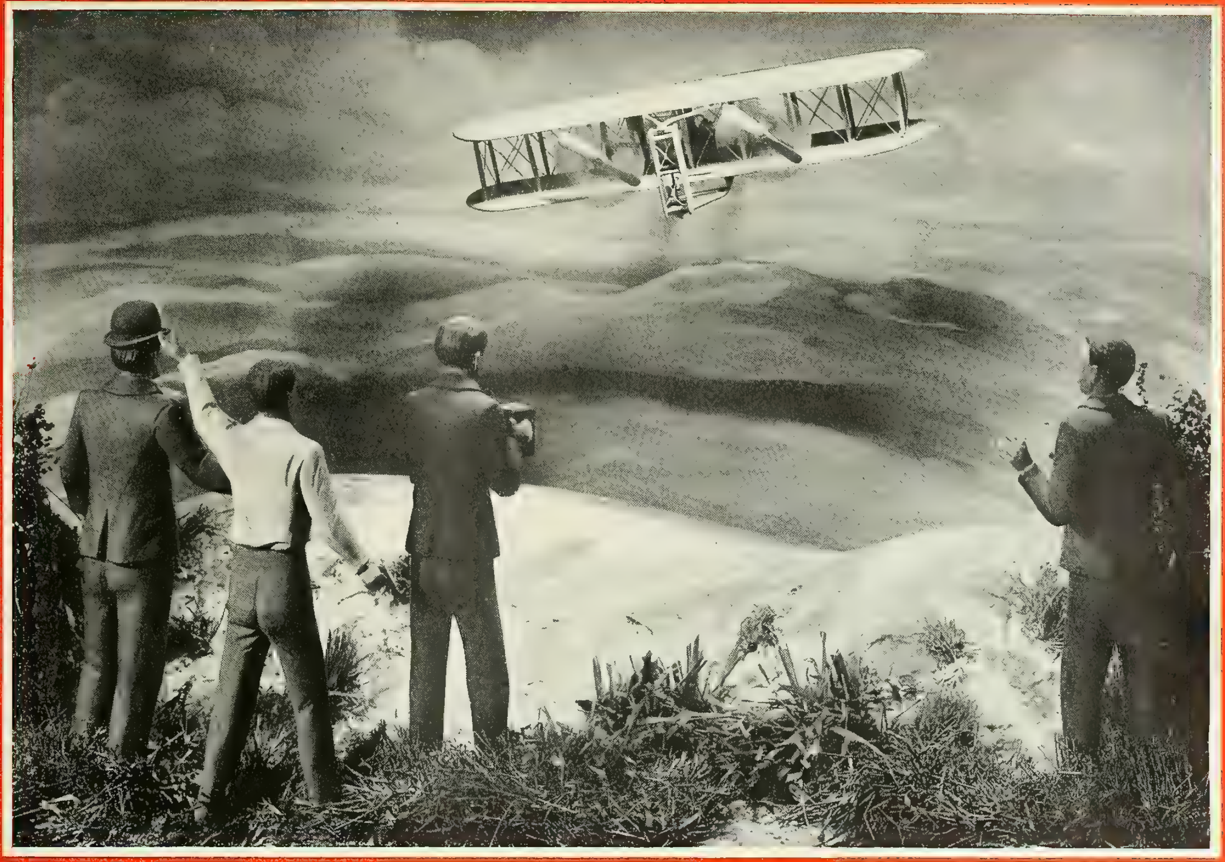
(*Continued on page* 102)

At the right is shown the Bergameschi A.P.1 single-seater powered by a 600 hp air-cooled engine



The A.P.1, produced by a Caproni subsidiary, has a one-piece cantilever wing of wood and plywood

Fiat C.R. 32 and C.R. 33.
Both these types are equipped with 12-cylinder Fiat water-cooled engines



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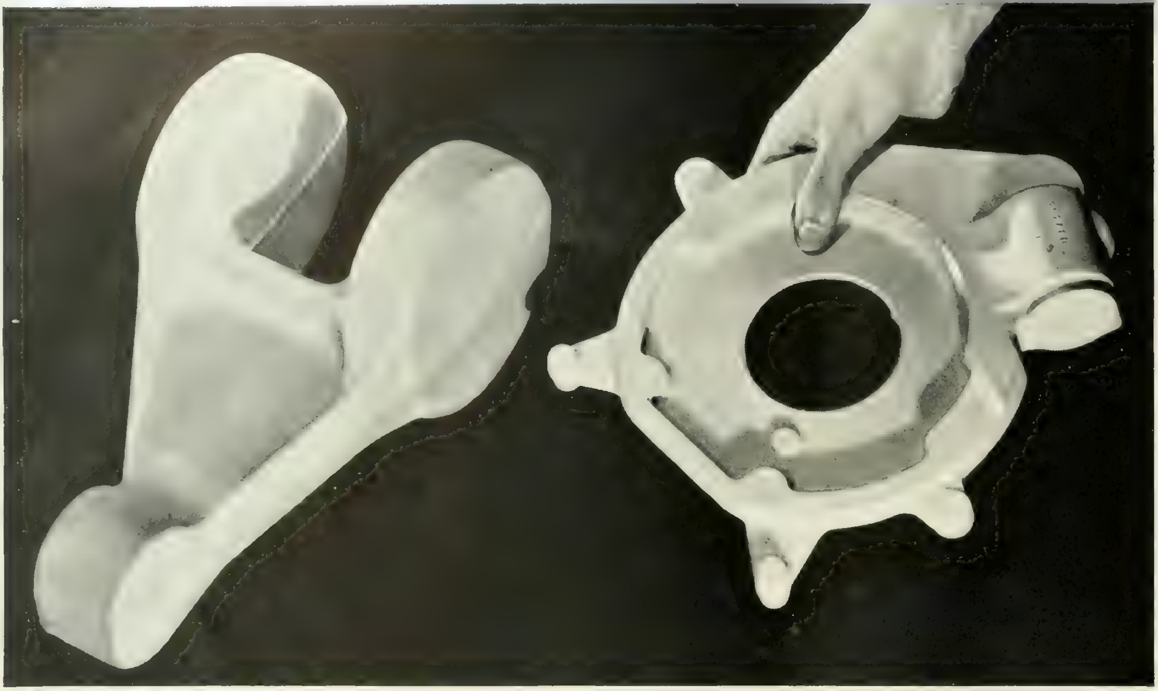

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INSTRUMENT LANDING SYSTEMS FOR AIRCRAFT

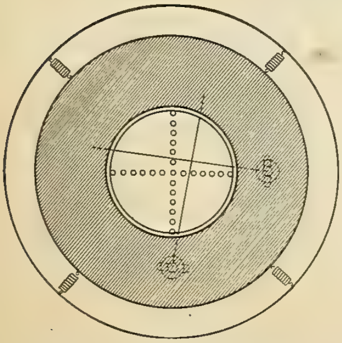
(Part 1)

HENRY W. ROBERTS

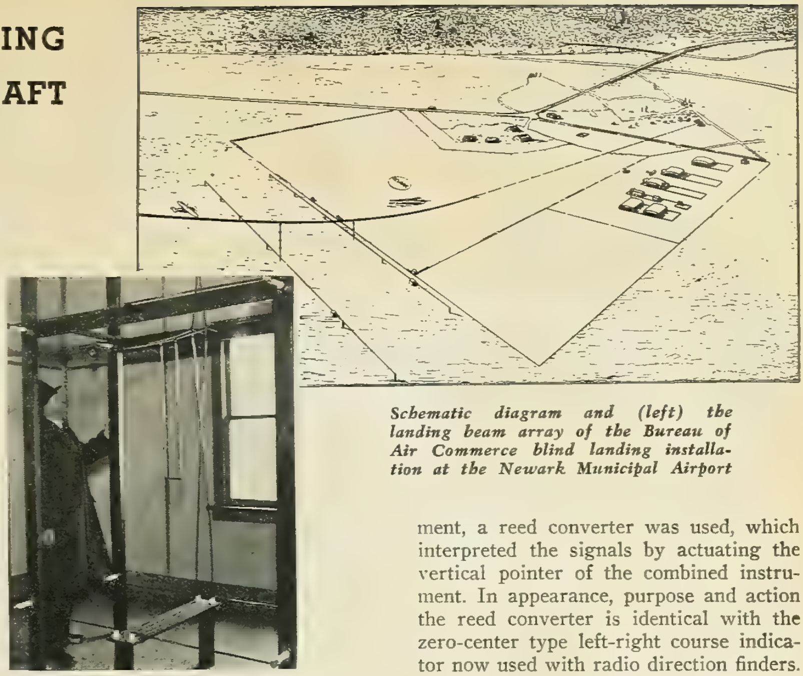
● Not less than seven methods of blind landing have been successfuly demonstrated in flight. Not less than two commercial airlines—Pan American Airways and Deutsche Zeppelinreederei—make use of instrument landing on their regular schedules as a matter of course. Thousands of "blind" landings have been made, and more are being made daily.

As far as instrument flight between two points is concerned, the problem of arriving over the point of destination is easily solved by modern radio aids—the radio range beacon system or a radio direction finding system. The present problem is how to bring the ship within the airport limits, and effect a safe landing without seeing the ground. To accomplish this the pilot needs three-fold information—in what direction the airport lies; how far away; and how far below. This information must be continuously and automatically available to define a spatial landing path from a point in space above the ground to a point on the airport runway.

The ideal instrument landing system has yet to be built, but the work already accomplished in this direction unmistakably points the way to the final solution. Eight successful systems of instrument landing developed to date (seven of which have been tested in flight) are described in this series, and their merits considered. Part I includes information on the Bureau of Air Commerce system, the Army-Hegenberger system, and the United Air Lines system.



The combined instrument of the Bureau system consists of two crossed indicator pointers



Schematic diagram and (left) the landing beam array of the Bureau of Air Commerce blind landing installation at the Newark Municipal Airport

Bureau of Air Commerce System

The first practical instrument landing system was developed by H. Diamond under the auspices of the Bureau of Standards and the Bureau of Air Commerce (then the Department of Commerce, Aeronautics Branch) during 1930-1931. The first totally "blind" landing was made by M. S. Boggs on Sept. 16, 1931. The Bureau's experiments were first conducted at College Park, Md., and after the system had been perfected, a trial installation was made at the Newark Municipal Airport.

This system fulfilled all requirements for instrument landing in that it continuously and automatically provided lateral, longitudinal and vertical guidance, i.e., it indicated in what direction the airport lay, how far away, and how far below. It withstood the test of time, has been often imitated, and, with very few refinements, is probably destined to become the accepted instrument landing system for land aircraft operation.

In the original installation at Newark lateral guidance was provided by a runway localizing beacon operating in the radio range beacon frequencies (200-400 kc.). A 200-watt transmitter was used, feeding two small multi-turn antennas, oriented to coincide with the landing direction.

For reception of lateral guidance, a standard beacon type receiver was employed, fed by a pole antenna atop the fuselage. Directional sensitivity was made possible by an addition to the pole antenna of a flat-top element extending to the tail. Reception of signals was visual, but instead of a vibrating reed instrument, a reed converter was used, which interpreted the signals by actuating the vertical pointer of the combined instrument. In appearance, purpose and action the reed converter is identical with the zero-center type left-right course indicator now used with radio direction finders.

Vertical guidance was provided by an ultra-short-wave transmitter, operating at a frequency of 90,800 kc. (3.3 m), feeding a directional antenna array, oriented in the landing direction and set at a slight angle to the ground.

For reception of vertical guidance, a simple ultra-high-frequency receiver was used, fed by two horizontal half-wave antennas located slightly forward of the leading edge of the wing. This arrangement was sensitive to the horizontally polarized waves emitted by the ultra-short-wave transmitter, and actuated the horizontal pointer of the combined instrument, indicating (in the vertical dimension) the position of the airplane in relation to the gliding path. By keeping this horizontal pointer centered, the pilot could follow a line of constant field intensity to a safe landing.

Longitudinal guidance was provided by two methods. First, the approximate distance from the airport and the rate of approach were indicated by a direct current milliammeter connected in the plate supply to the radio frequency amplifying tubes of the beacon receiving set. As the airplane approaches the transmitter, there is an increase in the field intensity of the runway beacon transmitter, and the input voltages to the receiver consequently increase. The receiver is equipped with automatic volume control; and since the automatic volume control, under these conditions, operates to increase the negative biasing voltage on the grids of these tubes, their plate current is approximately inversely proportional to the field intensity of the runway beacon.

Absolute longitudinal guidance was provided aurally. Two low power oscillators, feeding long horizontal antennas

Receiving antenna used on a Boeing by United Air Lines for making blind landings

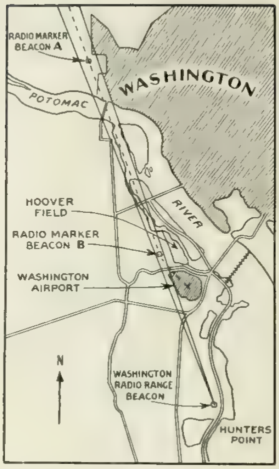
with radiation directed sharply upwards were employed. These two markers formed two "walls" of sound through which the aircraft had to pass as it followed the landing path to the airport. The first of these markers (in the original Newark installation) was approximately 2,500 feet from the edge of the airport, while the other was at the airport boundary. Two different modulation frequencies were employed for ready identification of these markers, and if the landing path was correctly followed, the height above the ground of the airplane's horizontal receiving antenna was 100 ft. at the first marker beacon, and 50 ft. at the second. The point of contact of the wheels with the ground depended on the distance between the horizontal antennas and the wheels of the airplane.

Although the system does provide the three-fold information which the pilot needs to make a safe landing without seeing the ground, his equipment on board the airplane was rather complex in the original version. To those familiar with radio, certain improvements, made possible by the research of the last four years, will suggest themselves. Such improvements would probably be found to have been already incorporated in the Lorenz and United Air Lines systems, both of which are based on the original Bureau of Air Commerce system.

The comparative immobility of the ground installation, which was oriented in the direction of prevailing wind, is a disadvantage. Although the beam could be swung within a 40° sector, it nevertheless did not provide instrument landing intelligence through the remaining 320°.

Despite its apparent complexity the system is simple. The following brief description of its operation may be of value to those whose knowledge of radio may be limited.

The accompanying illustrations, which apply to the Lorenz system, illustrate equally well the principles developed by Diamond. The principle of operation of the runway localizing beacon is identical



Bureau of Air Commerce blind approach system to airports as applied at Washington Airport

with that of the familiar radio range beacon. The drawing shows a two-course localizing beacon, employing a transmitting antenna and two reflectors. Radio waves emitted by this antenna arrangement propagate in the form of overlapping elipses. One reflector is keyed with dots, and the other with dashes (corresponding to the A and N signals of our range beacons). Points along the line XY (called the equisignal line) receive both signals with equal intensity. This line is the radio "beam"; four-course range beacons employ four reflectors, giving four beams.

If the airplane moves to the right or left of this line, either dashes or dots will predominate. The ratio of their predominance will depend on how far the airplane strays from the equisignal line, or beam, and to which side. Thus, along the line TAB, dashes will predominate over dots in the ratio of TB to TA.

The landing beam transmitter is adjusted at a slight angle to the ground, and the pear-shaped curved lines in the drawing represent loci, or points in space, where the field intensity (and consequently the signal strength) is equal.

The pilot approaches the airport at a convenient altitude, until the landing beam

Radio room at Oakland where United Air Lines is conducting its blind landing tests

pointer assumes horizontal position. The pilot begins gliding, and so long as he keeps the pointer horizontal, he knows that he is approaching the field along a line of constant field intensity which will lead him to a safe landing. The indicating instrument may be adjusted to follow as steep or as shallow a gliding path as the flying characteristics of that particular airplane may require. All such gliding paths eventually converge at substantially the same point of the runway.

Before concluding this brief description of the Diamond, or Bureau of Air Commerce, system, another development of his should be noted. It is the approach system to airports, utilizing the conventional radio range beacon. The illustrations show its applications at Washington.

As the pilot follows the radio range beam, the first marker A (at Georgetown), located 2.5 miles from the airport, warns the pilot to begin his glide preparatory to definite orientation. At marker B (at Arlington Farms), 2 miles away, his altitude should be 300 ft., and he gauges his glide accordingly. When beacon B is reached, at an altitude of 300 ft., the pilot changes his course for the airport runway—in this instance 22° to the left. The airport is now half a mile away, and no instrument landing system would be required except for ceilings under 100 ft.

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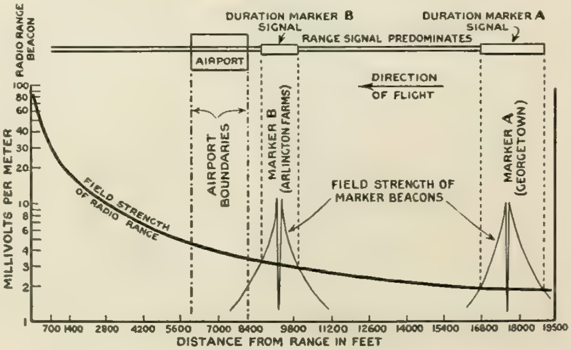
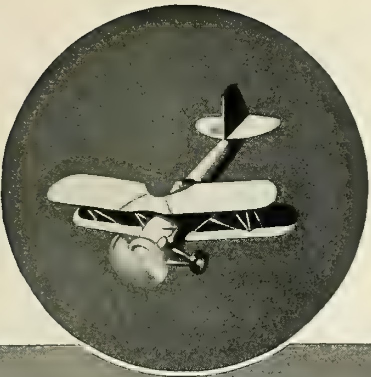


Field intensity diagram of the Bureau of Air Commerce blind approach system at Washington



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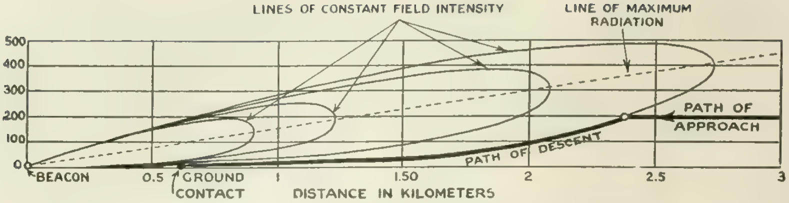


The Lorenz layout showing how a definite gliding path is provided

(Continued from preceding page)

Army-Hegenberger System

The Army-Hegenberger system of instrument landing is based on the use of recently developed radio direction finders. It should be more correctly called "instrument approach system," as it does not provide vertical guidance.

Its greatest virtue lies in the extreme elasticity of its operation, mobility, and light weight of both transmitting and receiving equipment. It is especially well adapted for military operation, as the entire system can be transported and set up at a regular or an emergency airport within a few hours.

The ground installation consists of two low-power non-directional mobile transmitters operating on separate frequencies. The two transmitters are oriented to coincide with the landing direction, and located at one side of the runway, at definite distances from the airport boundaries. The first transmitter is usually placed about 3 miles from the field, and the second at the field boundary.

The receiving equipment consists of an ordinary radio direction finder with its usual course indicating instrument. The pilot orients himself by taking bearings on the two transmitters, and, by trial and error, determines the compass bearing of the runway. With the runway defined, and the landing direction established, the pilot proceeds making trial approaches for a landing until he passes over the first transmitter at the prescribed altitude. This orients him with respect to the direction of the airport, distance to the airport, and altitude. From this point he takes a bearing on the second transmitter, and after that is passed, proceeds to land without further guidance.

Maj. Albert Hegenberger, who developed this system, has made numerous "blind" approaches and "blind" landings using this arrangement; and many other pilots who have tested it bring the total of approaches and landings made to several hundred. The system has apparently given satisfaction in service, despite its lack of vertical guidance, such as is found in the Diamond sytem. It is, however, doubtful if this system will be adopted commercially in its present form because of its insufficient demarcation of the landing path.

Considerable additional experimental work is now being done with this system. The Diamond system at Newark was abandoned in the Fall of 1934, and the Army-Hegenberger system "adopted as standard" by the Bureau of Air Commerce. In order to investigate its suitability for commercial operation, arrangements were made, in February 1935, to install a combination of the Army-Hegenberger-Bureau of Air Commerce system along the route flown by Transcontinental and Western Air. It is interesting to note that the Diamond ultra-short-wave landing beam, once abandoned, has been quietly reinstated, at least in the Indianapolis installation.

United Air Lines System

Much interest has been attracted by the instrument landing work conducted this year by United Air Lines at Oakland Airport. They have revived the original Diamond system in its entirety, introduced and tested all the latest refinements made in it abroad since its virtual abandonment in this country, and have done considerable independent research.

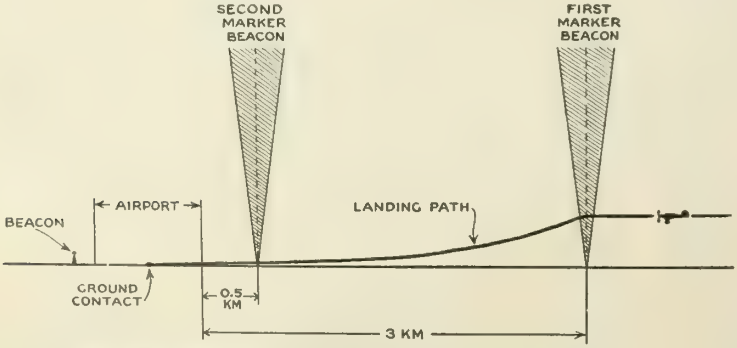
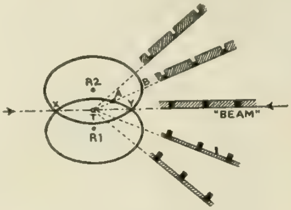


Diagram showing one of the Lorenz installations in Germany

The receiving antenna employed in one of their stock 247 Boeing airliners, in which instrument landing tests were made, is essentially the vertical pole antenna and the two horizontal half-wave antennas used in the original Diamond system, but the improvement in design and construction is unmistakable.

Their most interesting development, however, has been the utilization of the Sperry gyro pilot in conjunction with the system. This instrument eliminates, to a considerable extent, the human element, and relieves the pilot of the task of following the rapidly narrowing landing beam to the ground. The human pilot can devote more time to close observation of his landing instruments, while the "Iron Mike," assisted by but an occasional twist of the setting dials, keeps the ship steady on course.

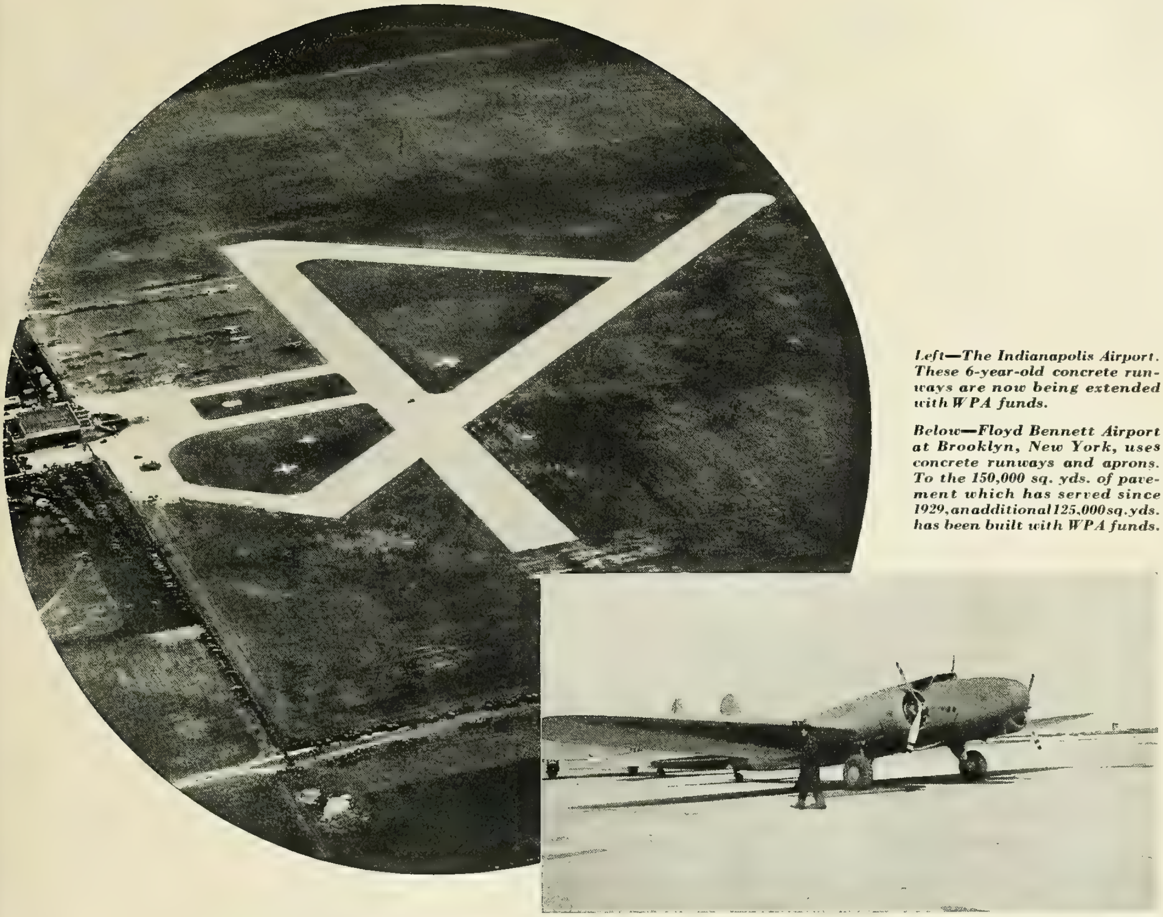
Another development of considerable value has been United's work with a relatively new type of marker beacon, which transmits an egg-shaped field and lights a neon light on the instrument board as the pilot passes through the marker beacon field. Similar marker beacons were used by Pan American Airways for altitude and position check because the field is clearly defined, and knowing the speed of the airplane and the duration of flight through the egg-shaped zone permitted a definite radio check on absolute altitude over the ground. Such beacons are now being installed by the Bureau of Air Commerce at terminal stations. They operate on a frequency of 91,000 kc. (approximately 3.3 meters), and are modulated with a 60-cycle tone. The egg-shaped field is projected to an altitude of approximately 12,000 ft., and at 5,000 ft. the field is approximately one mile wide. A light, compact and simple receiver for such marker beacons has been constructed by the Boeing School of Aeronautics.



Lorenz directional antenna array

During this summer, hundreds of instrument landings have been successfully made without a single mishap. This modernized Diamond system has apparently solved the airline's problem.

Part II will be devoted to a description of five more instrument landing systems—Pan American, Lorenz, Loth Electromagnetic, Simon, and Zeppelin-Telefunken. Requirements for an ideal system also will be discussed.



Left—The Indianapolis Airport. These 6-year-old concrete runways are now being extended with WPA funds.

Below—Floyd Bennett Airport at Brooklyn, New York, uses concrete runways and aprons. To the 150,000 sq. yds. of pavement which has served since 1929, an additional 125,000 sq. yds. has been built with WPA funds.

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Calculation of the Terminal Velocity of an Airplane in a Vertical Dive

●

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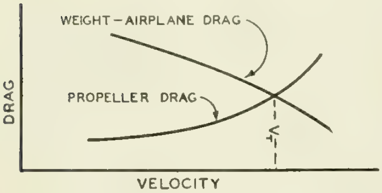
● The following presents a method of calculating the terminal velocity of an airplane either with a fixed or variable-pitch propeller. It has been found that results obtained by the authors' method, which has been used with considerable success since 1932, closely agree with the actual diving velocity of the airplane, and, hence, are suitable for design purposes.

Assumptions upon which the mathematical analysis is based are that (1) the motion of the airplane relative to the air is steady; (2) engine and propeller characteristics are known; (3) the effect of propeller slipstream is either neglected or accounted for by the propeller characteristics.

The following method simply comprises a graphical solution of the equilibrium relations:

Propeller drag = (gross weight-airplane drag) . (a)
Propeller torque = engine torque . . (b)

Relation (a) actually gives the terminal velocity, V_T, from a graph such as is illustrated. However, it is evident that relation (b) must be satisfied before it is possible to plot propeller drag directly against velocity of dive, as required in obtaining the graphical solution of (a).



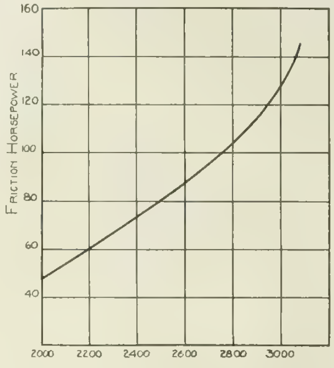


FIG. 1

Analysis

Propeller characteristics are usually expressed as functions of the ratio of "effective pitch" to diameter, i.e., (V/nD) where

V = velocity of translation
n = revolutions in unit time
D = propeller diameter

For convenience in calculation, the conventional nondimensional forms will be used

$$C_T = \frac{T}{\rho n^2 D^4} \text{ and } C_Q = \frac{Q}{\rho n^2 D^5}$$

where C_T and C_Q are respectively the coefficients of thrust (T) and torque (Q). The mass density of air is ρ. The above coefficients may also be expressed in the following terms:

$$C_T = \frac{T}{\rho V^2 D^2}\left[\frac{V}{nD}\right]^2 \text{ and}$$

$$C_Q = \frac{Q}{\rho V^2 D^3}\left[\frac{V}{nD}\right]^2$$

The equilibrium relations (a) and (b) in a steady dive may now be written symbolically as follows:

$$T = \rho C_T n^2 D^4 = W - \rho C_D S V^2/2 \quad ..(1)$$
$$\text{or} = W - (\rho/2) C_D S V^2$$
$$Q = \rho C_Q n^2 D^5 = 550(\text{FHP})/2n\pi \quad ..(2)$$

where, in addition to the notation previously given,

W = gross weight of airplane
C_D = drag coefficient of airplane *without propeller*
S = total wing area
(FHP) = "friction" horsepower of engine

As a first step, therefore, in the solution of the problem, the FHP curve of figure 1 is transformed into a curve of required torque coefficient C_Q versus n, by means of the relation

$$C_Q = 550(\text{FHP})/2\pi\rho n^3 D^5 \quad ....(3)$$

It should be noted here that the propeller diameter and blade angle must have been determined or assumed before beginning the calculations.

From the propeller characteristic curves, C_T and C_Q versus (V/nD) or against (nD/V) as they are usually plotted for the "windmill" region of operation illustrated in figures 2 and 3, one may obtain the values of nD/V, and C_T corresponding to the required torque coefficient determined above. Then, since the propeller diameter is known, V is obtained by

$$V = nD/nD/V \quad ....$$

If desired, the work may be tabulated as shown below.

n	C_Q	$\frac{nD}{V}$	n D	V	C_T	T

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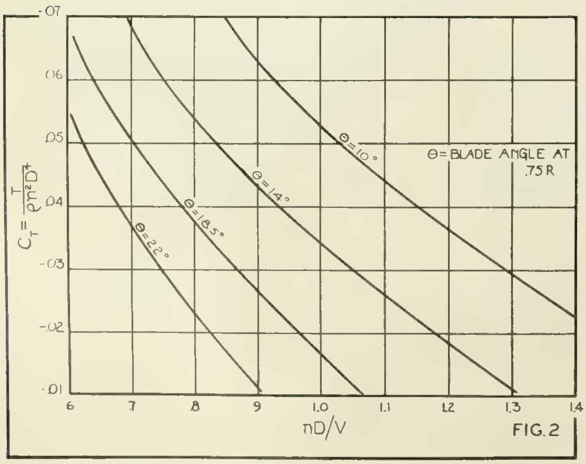

FIG. 2

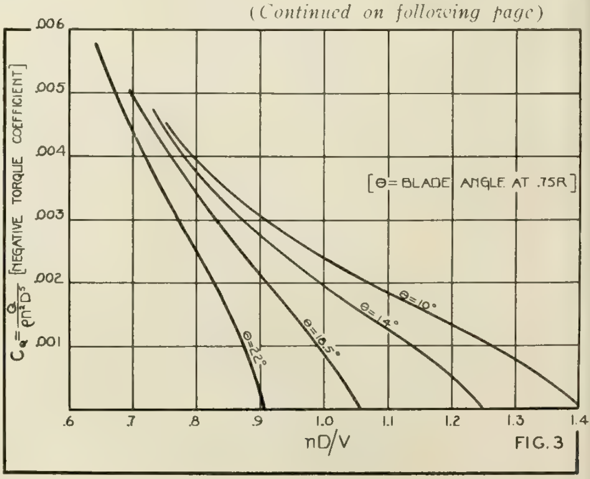

FIG. 3

AGAIN! Boeing military design foreshadows the trend in commercial air transports

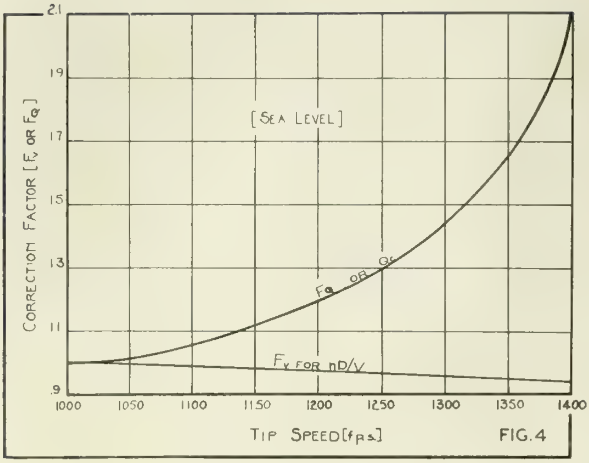

FIG. 4

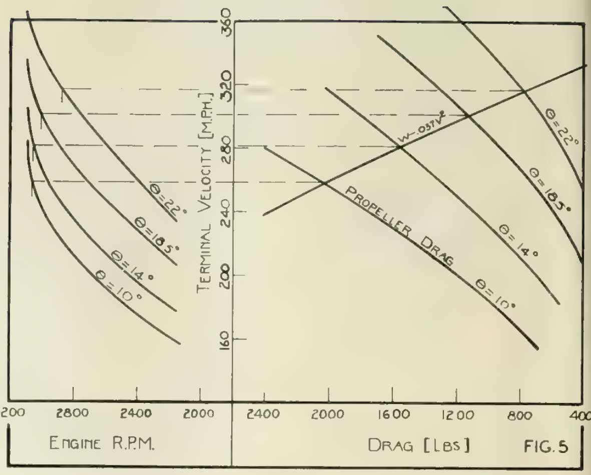

FIG. 5

(Continued from preceding page)

Thus the curve of propeller drag versus velocity has been determined. In obtaining the curve of (weight-airplane drag) the airplane drag may be found as follows:

It will be noted that in a terminal vertical dive the induced drag of the wings is practically zero. Then we can assume with sufficient accuracy in the case of a modern high speed airplane that the drag coefficient in a zero lift dive is equal to the ***profile drag coefficient at maximum level flight speed.*** Now, since

$$C_D = C_{D_o} + C_L^2 S/\pi(kb)^2$$

where

C_{D_o} = profile drag coefficient of entire airplane
C_L = lift coefficient
b = span of (longer) wing (for a biplane)
k = ratio of span (b) to that of a monoplane carrying the same load with same induced drag; that is $(kb)^2/S$ is equivalent monoplane aspect ratio

The drag coefficient for zero lift dive is

$$C_{D_o} = C_D - C_L^2 S/\pi(kb)^2$$

$$= \frac{550\eta_M(\text{BHP})_M}{(\rho/2)SV_M^3} - \frac{C_L^2 S}{\pi(kb)^2}$$

where

BHP = brake horsepower
η = propeller efficiency

The subscript M refers to the maximum speed condition.

Now

$$C_L = W/(\rho/2)SV_M^2$$

Equation (1) becomes

$$(\text{Propeller drag}) = W - \left[\frac{550\eta_M(\text{BHP})_M}{V_M^3} - \frac{2}{\pi\rho V_M^4}\left\{\frac{W}{kb}\right\}^2\right]V^2 \ldots\ldots\ldots\ldots\ldots(5)$$

The terminal velocity can then be determined graphically—as previously explained—by means of equation (1), since the necessary information for plotting T versus V, and $(W-(\rho/2)C_D SV^2)$ versus V has been obtained.

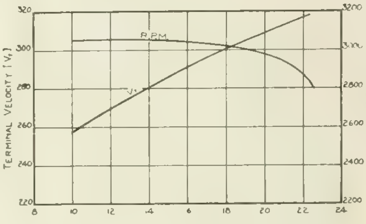

FIG 6

The foregoing method becomes slightly more involved when corrections are made for the mean blade width ratio of the propeller (MBWR) and tip speed. The former correction is due to the fact that the propeller characteristics, figures 2 and 3, are plotted for a MBWR = .1. In order to make these corrections in a logical manner, it is best to assume or make a rough calculation of the terminal velocity and calculate the tip speed from

$$\text{Tip speed} = \sqrt{(\pi nD)^2 + V_T^2}$$

The correction factors for C_Q and nD/V are given on figure 4.

Having determined C_Q (equation 3) it is necessary to correct it as follows:

$$C_Q' = C_Q \times F_Q \times 0.1/\text{MBWR}$$

where

F_Q = tip speed correction factor for torque
MBWR = (blade width at .75 radius × number of blades)/Diameter

Then, proceeding further, C_Q' and figure 3 may now be used and $\left\{\frac{nD}{V}\right\}'$ **obtained.**

The velocity is simply

$$V(\text{mph}) = (nD)' \bullet \frac{1}{\left\{\frac{nD'}{V}\right\}} \bullet \frac{1}{1.467}$$

Before securing C_T (the reciprocal of the effective pitch ratio), $\left\{\frac{nD}{V}\right\}'$ must be corrected for tip speed.

$$nD/V = (nD/V)' \bullet F_v$$

where

F_V = correction factor for $\left\{\frac{nD}{V}\right\}$ figure 4.

C_T is then determined from figure 2. The value of C_T thus found is for a MBWR = 0.1 and a tip speed of 1000 ft/sec. or less. The former correction is made directly and the latter is made when calculating the thrust, by using the "***n***" corresponding to the corrected nD/V. This is a fictitious "n" and is used only in the calculation of the thrust.

$$n = \frac{nD}{V}(V \times 1.467/D)$$

or

$$n = n' \bullet F_v$$

hence

$$C_T' = C_T(\text{MBWR}/0.1)$$

$$T = \rho n^2 D^4 C_T'$$

The remainder of the process for determining the final corrected value of V is the same as previously explained.

The above general method is illustrated in a numerical example given below. The pronounced effect of propeller blade angle upon terminal dive velocity is apparent from the results presented in figure 6.

Numerical Example of the Determination of the Terminal Velocity

Airplane Characteristics:

Maximum span	34.39 ft.
Span factor (k)	1.07
Maximum velocity (sea level)	147 mph
Gross weight	4500 lbs.
Wing area	300 ft.^{2}
B.HP (sea level)	420

Propeller Characteristics:

Number of blades	2
Diameter (D)	8 ft. 6 in.
Blade width at 0.75 radius	7.97"
Blade angle at 0.75 radius	variable pitch
Maximum propeller efficiency (η)	82.5%

Symbols:

N	revolutions per minute
n	revolutions per second
D	propeller diameter (ft.)

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V_T .... terminal velocity

F_Q .... torque correction factor due to tip speed

F_V .... nD/V correction factor due to tip speed

MBWR .... mean blade width ratio

Calculations

$$\text{MBWR} = \frac{\text{Blade width at .75 Rad.} \times \text{No. of Blades}}{D}$$

$$\text{MBWR} = \frac{7.97 \times 2}{8.5 \times 12} = .156$$

Minimum drag coefficient (Eng. Units)

$$D_C = \frac{375\eta_M \text{BHP}}{V_M^3} - \frac{124.5}{V_M^4}\left[\frac{W}{kb}\right]^2$$

$$= \frac{375 \times .825 \times 420}{(147)^3} - \frac{124.5}{(147)^4} \times \left[\frac{4500}{1.07 \times 34.39}\right]^2$$

$$= .041 - .0040$$

$$= .037 \text{ lbs./mph}^2$$

Calculation for curve of ($W - .037\ V^2$)

Vmph.	037 V^2	$W - .037\ V^2$
200	1480	3020
220	1790	2710
240	2130	2370
260	2500	2000
280	2900	1600
300	3330	1170
320	3790	710
340	4280	220

Calculation of Propeller Drag

C_Q is obtained from the friction horsepower curve

$$C_Q = \frac{\text{F.HP} \times 550}{2\pi n} \bullet \frac{1}{\rho n^2 D^5}$$

$$\text{tip speed} = \sqrt{(\pi n D)^2 + (V_T)^2}$$

Assume

$V_T = 300$ mph or 440 ft./sec.

Corrected torque coefficient

$$C_Q' = C_Q \times F_Q \bullet \frac{0.1}{\text{MBWR}}$$

The remaining calculations are given in the following tables:

N′	n′	F.HP	n′D	C_Q	Tip Speed	F_Q	F_V	C'_Q
2200	36.7	61	312	.001023	1075	1.028	.9901	.000674
2400	40	74	340	.000959	1155	1.114	.9785	.000685
2600	43.3	88	368	.000899	1240	1.275	.9615	.000727
2800	46.7	104.5	397	.000851	1325	1.550	.9487	.000846
3000	50.0	128	425	.000849	1405	2.247	.9346	.001223
3100	51.7	148	439	.000888	1450	3.778	.9302	.002148

C_Q'	$(nD/V)'$ (from figure 3)				$V_{mph} = \text{n'D} \bullet 1/(nD/V)' \bullet 1/1.467$			
	$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$	$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	22°
000674	1.320	1.180	1.017	.889	161	180	209	239
000685	1.318	1.178	1.015	.888	176	197	228	261
.000727	1.312	1.173	1.012	.887	191	214	248	283
.000846	1.295	1.160	1.003	.883	209	233	270	306
001223	1.225	1.105	.974	.866	237	262	297	335
.002148	1 040	.975	.900	.818	288	308	333	366

$nD/V = (nD/V)' \bullet F_v$				C_r (from figure 2)			
$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$	$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$
1.307	1.168	1.007	.880	—.0287	—.0210	—.0159	—.0135
1.290	1.153	.993	.869	—.0298	—.0222	—.0172	—.0147
1.262	1.128	.973	.853	—.0318	—.0240	—.0192	—.0165
1.229	1.101	.952	.838	—.0342	—.0263	—.0213	—.0184
1 145	1.033	.910	.809	—.0404	—.0316	—.0255	—.0220
.967	.907	.837	.761	—.0564	—.0426	—.0333	—.0282

$C_r' = C_r \times .156/.1$				$n = n' \times F_v$			
$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$	$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$
—.0448	—.0328	—.0248	—.0211	36.3	36.3	36.3	36.3
—.0465	—.0346	—.0268	—.0229	39.1	39.1	39.1	39.1
—.0496	—.0374	—.0300	—.0257	41.6	41.6	41.6	41.6
—.0533	—.0410	—.0332	—.0287	44.3	44.3	44.3	44.3
—.0630	—.0493	—.0398	—.0343	46.7	46.7	46.7	46.7
—.0880	—.0665	—.0519	—.0440	48.1	48.1	48.1	48.1

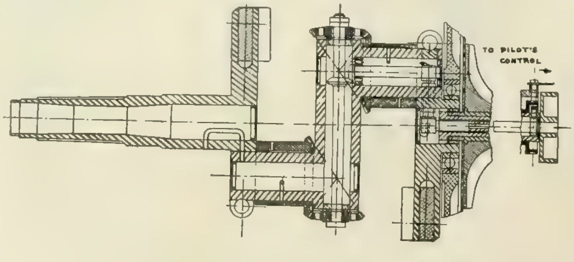
$T = C_r' \rho n^2 D^4$			
$\theta = 10°$	$\theta = 14°$	$\theta = 18.5°$	$\theta = 22°$
— 733	— 537	— 406	— 345
— 882	— 657	— 509	— 435
—1066	— 803	— 644	— 552
—1298	— 999	— 809	— 699
—1706	—1335	—1077	— 929
—2527	—1910	—1491	—1264

Digest of Technical Articles from Foreign Publications

Engines

Aircraft Engine of Variable Compression. (Il Motore a Rapporto di Compressione Variabile nel Campo Aeronautico, Aldo Cresta, Rivista Aeronautica, Anno XII, No. 7, Luglio 1936).

The invention described in this article consists of elecro-mechanical means of varying compression of aircraft engines. The application is for a twin row radial engine and its functioning is apparent from the accompanying schematic diagram. After treating the mechanical feature of the device and an abbreviated analysis of structural and dynamical considerations, the author reviews the advantages to be gained with such an arrangement. He compares the power of an ordinary aircraft engine at 2500 ft. with that having a variable compression feature. Assuming the permissible compression has a value of 12:1 instead of 6:1 he demonstrates how combined gain from greater stroke and compression results in a relative gain in power (at 2500 ft.) of 35%. He further analyzes the performance of supercharged explosion as well as injection type engines, arriving at considerable gains in all types for the case of incorporation of variable compression.



Crankshaft section showing means for varying the stroke and compression of aircraft engines during flight

Aerodynamics

Note on Effect on Static Pressure Along the Axis of an Open Jet Tunnel of (a) Nozzle Flare, and (b) A Ring in the Collector. By F. B. Bradfield, M.A., and G. F. Midwood. Communicated by the Director of Scientific Research, Air Ministry, (Great Britain) Aeronautical Research Committee, Reports and Memoranda No. 1695, *Nov.* 1, 1935.

In designing an open jet tunnel, power can be saved by keeping the jet length short, since approximately half the total power is expended on the edge of the open jet. If the length is reduced to say 1.25 times the mean jet diameter, the length of body whose drag can be measured in the tunnel without serious corrections due to change in static pressure along the tunnel axis is about 0.75 times the jet diameter. This may restrict the utility of the tunnel, and tests were made to find a means of keeping constant static pressure over almost the full length of an open jet tunnel.

If the fan is set back some distance in the collector, so that there is room inside the collector to fit a ring, it seems to be possible to obtain sensibly constant static pressure from nozzle to collector, so that a short jet may be used. There will be a saving in power, primarily because the open jet causes a serious power loss, and shortening the jet effects a saving, but also to a secondary degree because adding the ring will reduce the power needed.

(*Continued on following page*)

"Glorious Trip"

Travelers returning from South America via Pan American and Pan American-Grace Airways speak in glowing terms of their "glorious trip" and the "marvelous equipment". One of the outstanding features of this international service is its steadily growing fleet of Sikorsky S-43 Amphibions. This modern airliner, representing the last word in swift and dependable transportation, is powered by two Pratt & Whitney Hornets and equipped with Hamilton Standard Constant Speed Propellers. Seasoned passengers quickly appreciate its high performance, quiet comfort, and the high-wing construction which provides full vision from every one of its 15 seats.

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(Continued from preceding page)

Aircraft

Research on a New Type of Aircraft; l'"Hélicoplan" (Recherches sur un Nouveau type d'appareil volant; l'"Hélicoplan," Jean M. Lado-Bordowsky, Ingénieur Civil de l'Aéronautique, L'Aéronautique, No. 206, Juillet 1936).

The principle involved in the *Helicoplan* consists in coupling an autogyro rotor with a wing. The author states that his researches indicate that there is an optimum location for the rotor and that the best results were obtained with two rotors having opposite sense of rotation. It is also important that of the two possible senses of rotation one gives best results. The rotors which may be autorotative or powered, are located a certain distance below the chord of the wing, their axis of rotation apparently being in line with the aerodynamic center of the airfoil. The beneficial effect (as appears from the polars) is due partly to the lift produced by the rotor and partly to the increased lifting power of the airfoil. The latter is logical since the rotor assumes effectively the part of a flap. Lado-Bordowsky classes his invention with the group of variable area devices inasmuch as the primary object of the rotors is supplied in landing and taking-off. Once in the air the rotors are stopped so that they are in line (the author is apparently considering two-bladed rotors) with the relative wind and the wing alone becomes the supporting surface.

Propellers

Propeller Problem in High-Speed Aircraft, N. E. Joukowski's Central Aero Hydrodynamical Institute. I. B. Ostoslavski, Technique of the Air Fleet, No. 7, July 1936.

With increase in speed, range, supercharging of aircraft engines and other factors, the question of obtaining maximum efficiency with a satisfactory take off and climb performance requires a closer scrutiny of the problem of propeller behavior.

Ostoslavski arrives at the following conclusions: (a) for high speed aircraft it is best to employ multi-bladed large diameter propellers, (b) there is an optimum gear ratio reduction which is a function of the air temperature, speed of aircraft and final propeller diameter, (c) it is best to use a greater number of small propellers than a small number of large ones. The author stresses the point that his conclusions are based on an investigation whose accuracy fully depends upon Prandtl's formula on tip losses, which needs further experimental verification. He also states that the available data on static thrust of modern propellers must be supplemented with further research, preferably with full size propellers working under free-air condition.

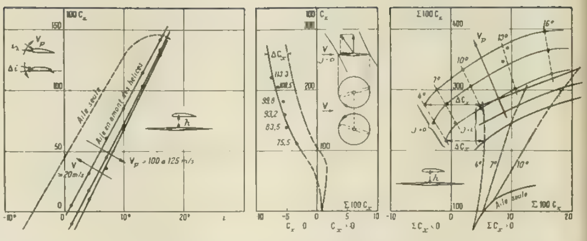
Aileron Flutter

The Effect of Variation of Aileron Inertia and Damping on the Flexural-Aileron Flutter of a Typical Cantilever Wing. By V. M. Falkner, B.Sc., A.M.I. Mech.E., of the Aerodynamics Department, N.P.L., Air Ministry (Great Britain); Aeronautical Research Committee, October 17, 1935.

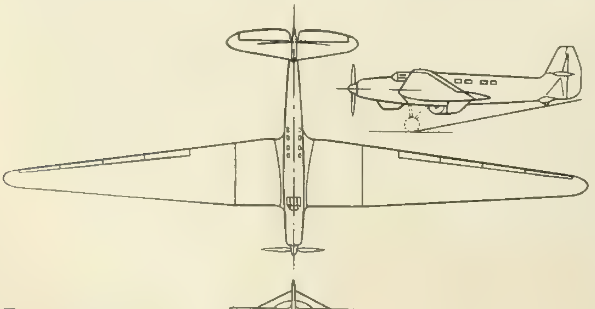
The present work forms part of an investigation on methods of flutter prevention, dealing with a dead-centre aileron control on a flexible model Puss Moth wing. It treats also the use of mechanical devices for artificially increasing aileron damping and moment of inertia.

Calculations have been made of the critical flexural-aileron flutter speeds of a cantilever wing, with a reversible aileron control of the usual type, of which the characteristics have been chosen to represent current practice as applied to high speed aircraft. Critical speeds have been calculated for a range of values of the product of inertia, the aileron inertia, and the aileron damping coefficient.

Use of a device which increases artificially the moment of inertia of the aileron, may lead to dangerous flutter conditions, whether used with or without mass balancing of the aileron. On the other hand, the artificial increase of the aileron damping is considered to be promising as an aid to the suppression of flexural-aileron flutter.



(Left): Effect on wing lift of two rotors placed below the airfoil (rotors disconnected from wing). (Center): Polars of the two rotors. (Right): Composite polar of the system obtained for an angle of attack of zero (for rotors' planes of rotation) and for three peripherical rotor speeds



Outline drawings of the 950 h.p. Russian monoplane ANT-25 described in the August issue of the Russian "Aeronautical Engineering"

Fuel Systems

Air and Vapour Locks in Fuel Systems by M. A. A. Allfrey, B.A., of the Royal Aircraft Establishment. Communicated by the Director of Scientific Research, Air Ministry, (Great Britain) Aeronautical Research Committee, Reports and Memoranda No. 1693, *January* 3, 1936.

Failures of aircraft engines have often been attributed to air or vapor in the fuel system. This report analyzes under what circumstances such failures could occur, and what should be done to prevent their occurrence.

Air locking was studied in the laboratory by observing the behavior of a fuel-air system in glass pipes; this led to diagnosis of an air lock as the cause of failure in an airplane and the investigation was continued on this aircraft to find the source and to measure the rate of accumulation of the "locking" air.

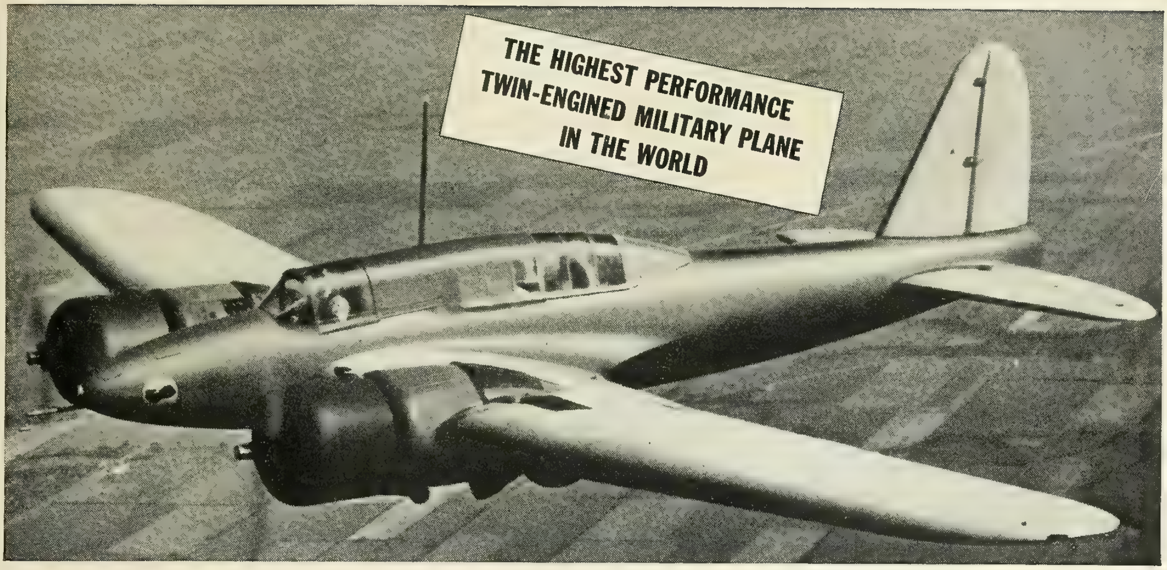
Apart from air introduced into the system in bulk, as in aerobatics, the amount of air in the fuel that can come out of solution when flying at height is ample to cause locking in a system susceptible to that trouble. A gravity fuel system can be air locked if it is possible for a large proportion of the head pipe-line to remain full of air over a range of fuel flows, stoppage being due to loss of the amount of head which would otherwise be given by the sections of pipe occupied by the entrapped air. Prevention lies in suitable lay-out of the upper part of the system coupled with use of the appropriate size of pipe. Pump systems which prime themselves cannot be air locked, but they will cease to function if the cock to an emptied tank below the pump is left open.

Interference with fuel flow brought about by the continued vaporization of the fuel may occur at the carburetor jet or at the suction side of the pump, its onset at a given height being governed by the fuel temperature. The vapor locking temperature is high near the ground but at great heights this temperature is lower and there appears to be likelihood of trouble. The cure lies in reducing the temperature of the fuel and in limiting the suction lift of the pump. At extreme heights, it would be advantageous as regards vapor locking to place the carburetor on the pressure side of the supercharger.

Aerodynamics

The Boundary Layer and Recent Developments, by Professor L. Bairstow, C.B.E., F.R.S., F.R. Ae. S.; The Journal of the Royal Aeronautical Society, No. 308, *Vol. XL, August,* 1936.

Professor Bairstow's introduction is the most adequate summary of the scope of his paper. "In what follows, a survey is made of a group of theorems relating to the resistance of various bodies such as airfoils and flat plates and more generally to streamline forms. The theorems are partly physical and partly mathematical and approximations are numerous and of very different degrees of validity. The equations of motion to be solved are known to an accuracy which satisfies all of us, but they are too difficult for solution by the mathematician; as a consequence some accuracy in physical conception is sacrificed in order to bring problems within the range that is soluble. Our subject divides itself into two sections, laminar and turbulent boundary theory, and in the first of these, departures from strict physical accuracy are moderate and such that theory seems logical. Turbulent boundary theory, on the other hand, strains the imagination to the limit and a great amount of empiricism remains even in the best efforts."



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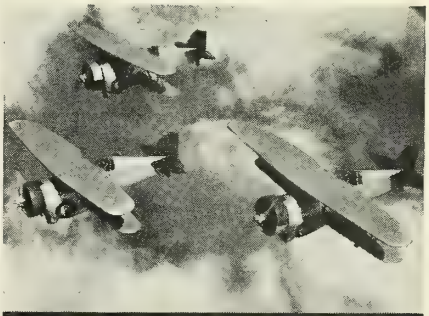


WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

CURTISS production lines have swung into action on another big order for "service" planes. The new YIA-18 Attack Planes will give the U. S. Army the last word in aggressive high-speed units.

Throughout the construction of these Army Fighters, Goodrich aviation products have important jobs. More than a dozen Goodrich products contribute to the safety and smooth operation of these ships—products that have been chosen again and again by Curtiss for their time-tested ability to give long, "trouble-free" service. More proof that the builder of the famous Goodrich Airplane Silvertown Tire is also the most able builder of the many other rubber products aviation needs today — whether simple gaskets or elaborate De-Icer equipment.

Why not give *your* planes the extra safety—the extra dependability of Goodrich-made airplane products? Remember, there are over 40 Goodrich rubber products for airplanes. See your nearest Goodrich Dealer or write Department 621, Aeronautical Division, The B. F. Goodrich Company, Akron, Ohio, for complete information.

At left: THE CURTISS SOC-1 Scout Observation Plane. Curtiss has already built 135 of these rugged ships as "eyes" for the U. S. Navy and 40 more are on the way. In addition to having Goodrich Airplane Silvertowns for extra landing safety, these Curtiss planes are built with many other Goodrich airplane products. Hidden from sight, these Goodrich accessories are chosen because they measure up to the high standard of dependability demanded by Curtiss.

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.

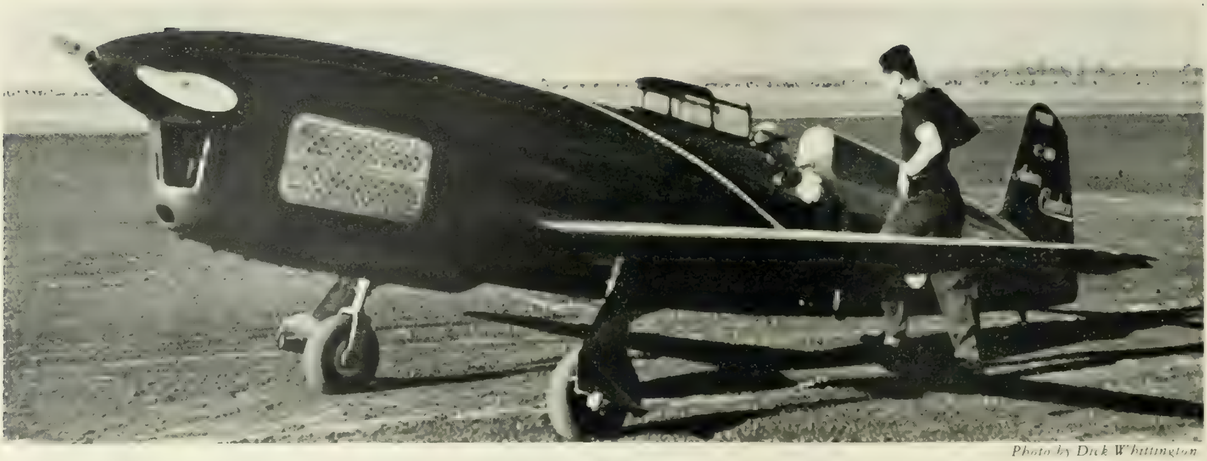


Photo by Dick Whittington

The French Caudron C-460 Racer

Winner of the 1936 Thompson Trophy Race

● Most notable plane at Los Angeles during the 1936 National Air Races was the French Caudron C-460 racer which Michel Detroyat piloted to victory in the Greve Trophy Race and again in the Thompson Trophy Race. This airplane created as great an impression by its tremendous speed as by its clean lines, skin-type oil radiator, and fully retractable landing gear. Also impressive was the efficiency of the two-pitch position Ratier propeller which aided in the creation of new speed records in the two events won by Detroyat.

The C-460 was developed originally for the 1934 Coupe Deutsche de la Meurthe Cup Race, but it did not compete in the event that year because of mechanical difficulties with the landing gear. However, when the trouble was corrected that same year, M. Delmotte established, in December, a new world's speed record of 314.2 mph. Delmotte then won the 1935 Deutsche de la Meurthe cup by flying the 1240-mile course at an average speed of 275.7 mph. During this event, speed records for 100 and 1000 kilometers were broken at 291.2 and 276.9 mph respectively by the C-460.

A single-seat low wing monoplane, the Caudron C-460 incorporates a fuselage with vertical sides, rounded top and elliptic bottom. Construction is of wood, cross-bracing members being of spruce and plywood. Sides are plywood covered and the entire structure is fabric covered. The pilot's cockpit is behind the trailing edge of the wing and is provided with a sliding canopy top.

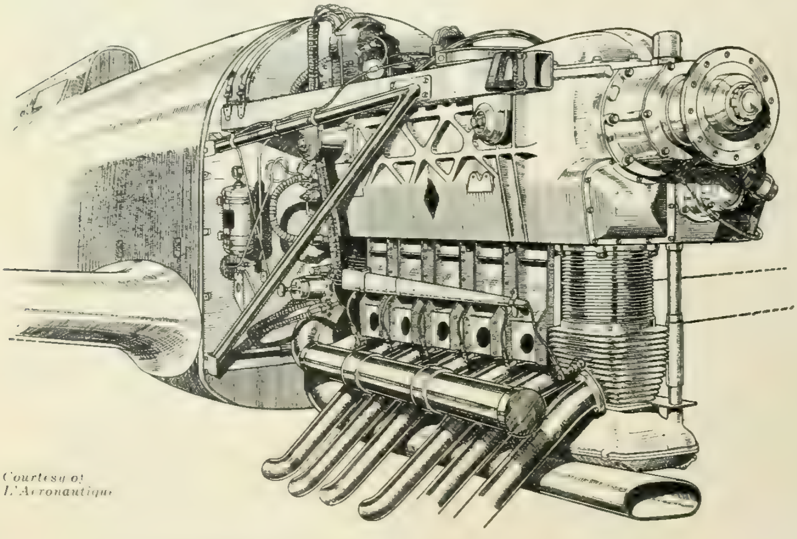
Wings are full cantilever, of biconvex section, and have a straight taper in plan view with the tips rounded. Structure consists of two spruce and plywood box spars, closely spaced spruce ribs and plywood covering. Ailerons are statically and aerodynamically balanced and from their inner portions, trailing edge flaps extend for the balance of the span, being equal to 30% of the chord and 60% of the trailing edge of each wing section.

Tail surfaces also are full cantilever, of wood construction, plywood and fabric-covered. The retractable landing gear consists of two Messier braced wheel forks which hinge inward and slightly rearward into wells on the underside of the wing. A metal covering on each wheel closes the aperture when the wheels are in the fully retracted position.

Although Detroyat's speed was 12 mph in excess of the best previous record for the Thompson Trophy Race, his engine has less than half the cubic inch displacement of any previous Thompson winner. The engine, a development of the Renault Bengali series, was built especially for the Meurthe cup race, and is known as the Renault Bengali-Coupe Deutsche. It is a six-cylinder inverted in-line air-cooled power plant which provides about 340 hp at 3200 rpm. Bore is 433 in., stroke 5.5 in., and cu. in. displacement 488.

Specifications of the Caudron C-460 as supplied to Aero Digest by Michel Detroyat, are as follows:

Wing span	22 feet 1 inch
Length overall	23 feet 4 inches
Height overall	5 feet 10 inches
Wing area	75.1 square feet
Empty weight	1298 pounds
Useful load	792 pounds
Gross weight	2090 pounds
Wing loading	27.8 lbs./sq. ft.
Power loading	5.65 lbs./hp.
Engine, Renault	340 hp at 3200 rpm
Maximum speed	314.2 miles per hour



Courtesy of L'Aeronautique

Sketch showing mounting of the Renault engine in the C-460 racer

33 Curtiss SBC-3 U.S. Navy Carrier Scout Bombers are now under construction at the Curtiss Aeroplane & Motor Company, Buffalo, N.Y., for the Navy Department, Bureau of Aeronautics.

CURTISS SBC-3

U.S. NAVY CARRIER SCOUT BOMBER

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CURTISS AEROPLANE & MOTOR COMPANY, INC.

BUFFALO *A Division of Curtiss-Wright Corporation* NEW YORK

"THE PIONEERS OF AVIATION"

The Dornier Do-18 Flying Boat

● Germany's bid for participation in the northern trans-Atlantic aerial route is being made with the Dornier long-distance flying boat Do-18, two of which last month completed notable over-water flights to this country.

While these boats are designed primarily for ocean mail carrying, they are adaptable for military use, particularly as long-range reconnaissance craft or bombers. Restricted to commercial use, the Do-18 type has been responsible for the continuance of the successful service between Germany and South American countries inaugurated by the heavier and slower Dornier Wal which it is replacing.

These flying boats, operated by Deutsche Lufthansa, are all-metal high wing braced monoplanes powered by two 550 hp Junkers Jumo 205-C V-type diesel engines. Flight range, based on a cruising speed of 130 mph is 2670 miles, fuel consumption being 2.29 lbs./mile; at a cruising speed of 112 mph, range increases to 2900 miles and fuel consumption is reduced to 2.05 lbs./mile.

Construction of the Do-18 hull follows semi-circular design, with the characteristic Dornier under-surface and lateral sponsons utilized. The V-type bottom forward becomes flatter at the first step, and at both sides of the keel are longitudinal steps extending parallel to it. Aft of the main step is a tapering step, at the end of which is a water rudder. The hull, of all-metal construction with a smooth skin outer covering, flush riveted, is strengthened for catapulting, since this system is utilized by Lufthansa in its present over-water operations.

Main stressed members of the hull framework consist of pressed or extruded duralumin sections, the hull being divided into 8 watertight compartments. Each sponson is subdivided by 6 bulkheads, and one compartment on each side is gasoline-tight so that about 250 gal. of fuel may be carried in these units.

The hull is divided into several compartments; forward is the bow compartment in which all marine equipment is stored and which extends to bulkhead 3. Behind that is the pilot's compartment between bulkheads 3 and 7. Dual controls are provided and on the instrument panel, navigation and engine instruments are so arranged that they can be read easily by day or night.

Entrance to the radio and navigation compartment (between bulkheads 7 and 10) is through a door in the pilot's compartment. Radio equipment, including direction finding apparatus, is on the starboard side and on the port side is a map table. An oil tank and fuel pump are between bulkheads 10 and 11 and to port there are accumulators, cooling water tank and bilge pump. Between bulkheads 11 and 14 is the fuel compartment which contains four aluminum tanks each with a capacity for 165 gals., and fitted with a dump valve. For repairs the tanks may be removed through a screw-down hatch on the deck. From these tanks fuel is fed into a collecting tank in the same compartment and from there to the engines. Between bulkheads 14 and 17 is the mail and freight compartment.

Trapezoidal in shape with rounded ends, the wing has two latticed duralumin spars. Wing structure is of all-metal construction, fabric covered throughout except at the section which is in the propeller slipstream where metal covering is utilized. Outer wing panels are bolted to the engine housing structure which serves as the center section. Wing section is thickest at the point where the struts are attached to the sponsons, and from this point outward and inward, spars taper to a narrower section. Ailerons and flaps are constructed as a double wing, and are behind the trailing edge.

The tail plane fairs into the fuselage and is so designed that when the aircraft

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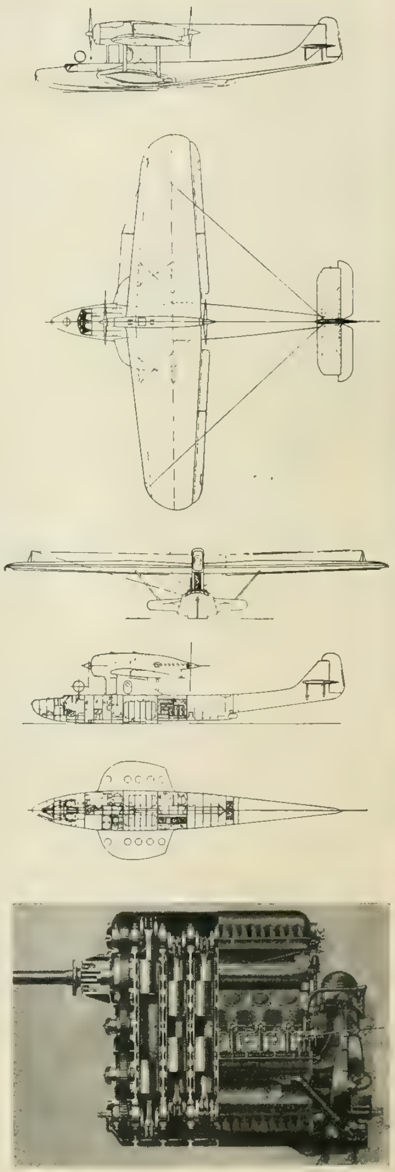
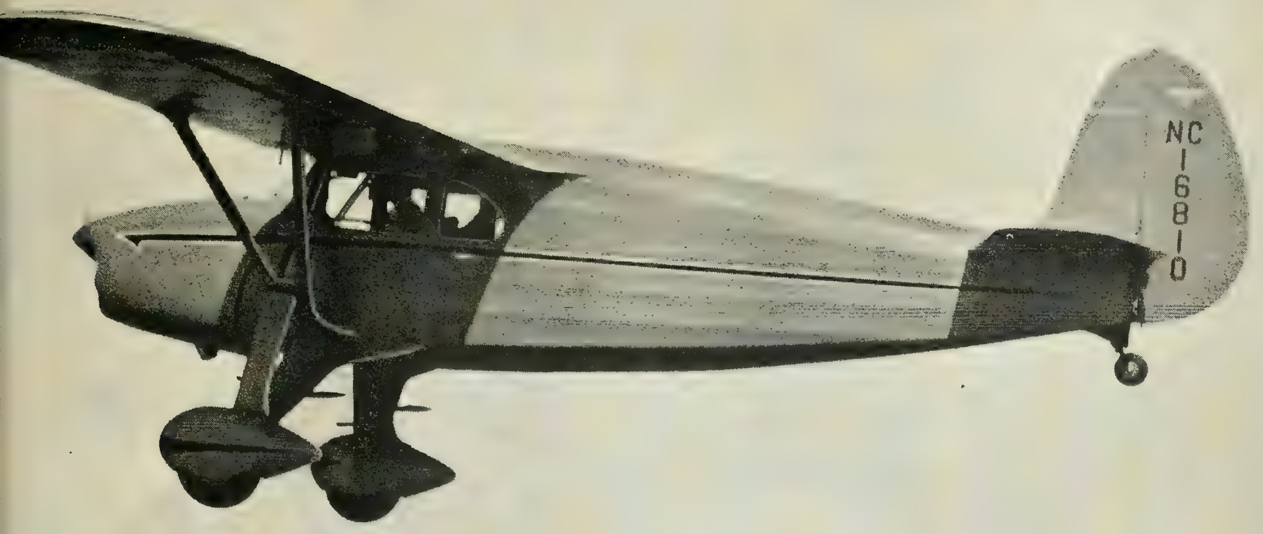
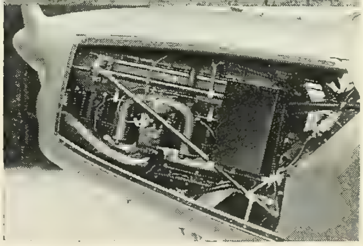


Outlines and sections of the Do-18 and of one of its two Junkers engines

The FAIRCHILD "24" with the RANGER ENGINE



SMOOTH TEAMWORK



he brilliant success of the new Ranger-powered "24" stems irectly from the unbeatable teamwork of a great plane and a reat engine combined in one unit to create a perfect airplane for e private owner. In this "24" the typical Fairchild qualities . . *ease of flying, safety* and *minimum maintenance* . . . are realized a greater degree than ever before.

With 60% less frontal area than corresponding radial types e inverted in-line Ranger engine contributes to the notably mooth flight of the Fairchild "24." Vibration-free power inherent in the Ranger design, clear vision r the pilot resulting from the low, slim engine cowling, absence of routine engine service except for as and oil (300-400 hours between major overhauls)—these are reasons why Ranger-Fairchild owners ecome no more "engine-conscious" than automobile owners.

Fly this ship for a new experience in relaxing comfort and perfect control, from take-off to landing. earn the thrill of its perfect balance and alert response in flight; its ease of landing in small areas. Here a plane with the flight characteristics of larger, costlier planes, yet so easy to handle that an amateur ilot can take the controls with perfect confidence. Tomorrow's Private-Owner Plane—made available day by Fairchild.

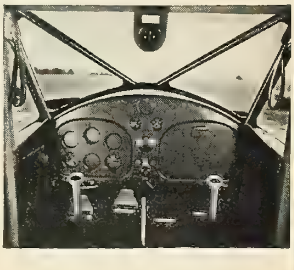
r full details see Fairchild distributor . . . or write directly to FAIRCHILD AIRCRAFT CORPORATION, Hagerstown, Maryland

FAIRCHILD "24"

Newest 1936 model of a cabin plane famous for its superb flight characteristics . . . Seats pilot and two passengers, with 50 pounds of baggage . . . Interior refinements include chrome-plated dual controls; safety-glass windshield; one-hand pilot-seat adjustment; rubber-mounted instruments, indirectly lighted; provision for easy radio installation, etc. . . . Ranger-powered, has a cruising speed at 5,000 ft. of 119 m.p.h.; stalling speed with flaps, 49 m.p.h.

RANGER ENGINE

150 h.p., 6-cylinder, inverted, in-line, air-cooled . . . Underhead camshafts actuate valves without push-rods, doing away with the need for regular valve adjustments and providing a constant bath of oil for the entire valve mechanism . . . an auxiliary shaft drives the engine accessories, insulating them against shock and vibration.



FAIRCHILD

AIRPLANES • RANGER ENGINES • RADIO COMPASS • CAMERAS • AERIAL SURVEYS • INSTRUMENT

(Continued from preceding page)

is on the surface there is adequate clearance with the water. The stabilizer is braced by a pair of struts on each side extending down to the hull and is adjustable in flight. Elevators and rudder are horn-balanced and the rudder is provided with an adjustable trailing edge trimming tab.

Engines are installed in tandem on vibration-absorbing mountings in the engine nacelle which fairs into the center section of the wing. The front engine drives a three-bladed tractor propeller, while the rear engine is situated between the spars and drives a pusher propeller by an extended shaft. Engine fairing is removable making the engines easily accessible; fairings at the sides of the front engine may be let down to serve as platforms for mechanics.

Two water radiators are situated one above the other in front of the turret forming a static streamlined connection of the fuselage and the engine nacelle. In top of the nacelle are two tanks for cooling water which can be replenished from the water tank in the hull between bulkheads 10 and 11.

In the experimental service between Berlin and New York planned by Lufthansa, Do-18 flying boats will operate from the German capital to a catapult ship which may be stationed near the Azores. After refueling the plane will be catapulted from the steamer to continue the trans-Atlantic crossing, although it might be decided subsequently to have another catapult ship in the vicinity of Bermuda.

Specifications and performances of the Do-18 with two 550 hp Junkers diesel engines are as follows:

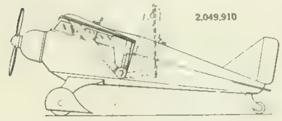
Wing span	77 feet 9 inches
Overall length	63 feet 3 inches
Overall height	17 feet 10 inches
Wing area	1054 square feet
Empty weight	11,814 pounds
Useful load	8,426 pounds
Gross weight	20,240 pounds
Maximum speed	155.25 miles per hour
Cruising speed	130.49 miles per hour
Landing speed	55.8 miles per hour
Service ceiling	14,432 feet
Cruising range	2670-2900 miles

Recent Aeronautical Patents

● The following recent patents of interest to readers of Aero Digest were compiled from the Official Gazette of the United States Patent Office.

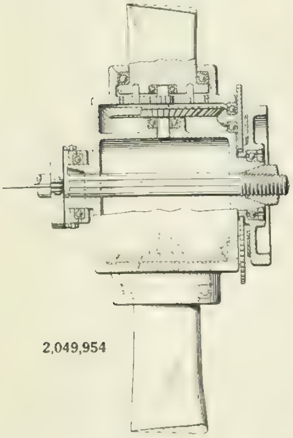
M. Shoemaker, Hartford, Conn., assignor to United Aircraft Corp. (2,049,751)

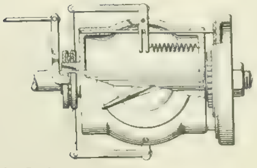
Airplane. Walter Kroll, Detroit, Mich. (2,049,910)



Piston. George C. Nienow, Plainview, Minn. (2,049,922)

Variable pitch propeller. Samuel Gilbert, Verona, N. J., assignor to Eclipse Aviation Corp. (2,049,954)





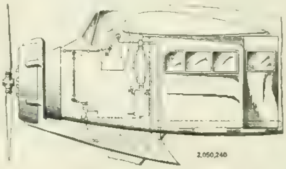
Double acting two-stroke cycle internal combustion engine. Johannes Miller and Frederick Ernest Rebbeck, Belfast, Northern Ireland. (2,049,819)

Course governor for dirigible craft. Paolo Orlando, Fiume, Italy, assignor to Silurifico Whitehead di Fiume Societa Anomina. (2,050,017)

Brake. Charles Putch, Jr., Texarkana, Tex. (2,050,121)

Propeller. Allen White, Newton, Kans. (2,050,142)

Heating and ventilating system for aircraft. Myron G. Beard, Farmingdale, N. Y., assignor by mesne assignments to Curtiss Aeroplane & Motor Corp. (2,050,240)

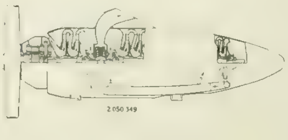


Position finding system. Lewis W. Chubb, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Co. (2,050,276)

Cabin chute. Edward L. Hoffman, Dayton, Ohio. (2,050,324)

Aircraft wing. Clinton W. Howard, Washington, D. C. (2,050,327)

Gas turbine system for aerial propulsion. Alf Lysholm, Stockholm and Gustav Karl William Boestad, Lidingo, Sweden, assignors to Aktiebolaget Milo. (2,050,349)



Aero and auto tire. James V. Martin, Garden City, N. Y. (2,050,352)

Aircraft radio altimeter. Thomas James Boerner, W. Collingswood, N. J., assignor to Radio Corporation of America. (2,050,418)

Piston. Adolph L. Nelson, Detroit, Mich., assignor to Bohn Aluminum & Brass Corp. (2,050,452)

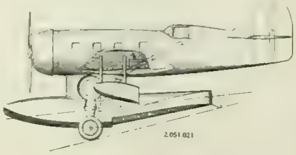
Aircraft. Helmuth Peter Holler, Poplars, Md. (2,050,570)

Engine. Henri Morreau, Queen Charlotte City, British Columbia, Canada. (2,050,578)

Wheel starter. Godfrey B. Speir, Hempstead, N. Y., assignor by mesne assignments to Curtiss Aeroplane & Motor Corp. (2,050,741)

Two-cycle engine. Rudolph Daub, Nutley, N. J., assignor to Wright Aeronautical Corp. (2,050,748)

Retractable landing gear. Giuseppe M. Bellanca, New Castle, Del. (2,051,021)



Motor mounting. William Feldermann, South Orange, N. J. (2,051,033)

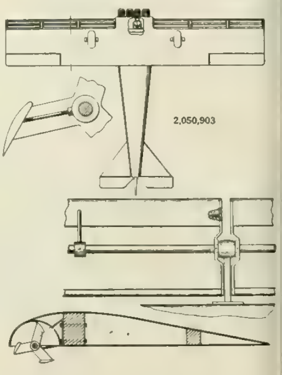
Flexible gun mount. Ralph M. Ferguson, Dayton, Ohio. (2,051,034)

Downdraft carburetor. Hiram H. Grazer, U. S. Navy. (2,051,038)

Parachute apparatus. Edward L. Hoffman, Dayton, Ohio. (2,051,044)

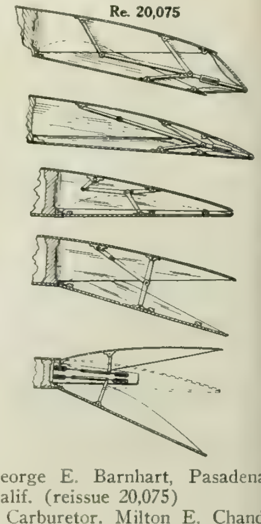
Valve tappet. Carl Voorhies, Buffalo, N. Y., assignor by mesne assignments to Wilcox Rich Corp. (2,051,232)

Airplane drive. Oliver Topliff, Springfield, Ill. (2,050,903)



Remote indicating thermometer. Clarence A. de Giers, Forest Hills, N. Y. (2,050,965)

Airplane wing construction. George E. Barnhart, Pasadena, Calif. (reissue 20,075)



Carburetor. Milton E. Chandler, South Bend, Ind., assignor to

(Continued on following page)

SKF-EQUIPPED
BUILT BY
SIKORSKY AIRCRAFT
DIVISION OF UNITED
AIRCRAFT MFG. CORP.

24,951 FT. IN THE AIR

SKF *gives bearing dependability to P. & W. Engines*

Climbing swiftly, safely, certainly, the Sikorsky S-43 recently reached four new highs for Class C-3 amphibions. With payloads of 500 and 2000 kilograms, it soared to official altitudes of 24,951 and 19,626 feet. It also broke two other world records for altitudes with 1000 kilograms payload and without payload . . . with SKF Bearings playing a definite part in these new achievements.

SKF Bearings always run smoothly at high speeds under heavy radial and thrust loads in the two 750 H. P. Hornet SIE-G Engines that propel this giant sky-liner. They assure dependability at speeds up to 186 miles per hour at sea level and landing speeds of 65 miles per hour. Yet SKF dependability is not limited to wings that fly to new records. In daily commercial service, too, it's accepted as a synonym for bearing safety.

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

3642

(Continued from preceding page) Bendix Aviation Corp. (2,051,820)

Electrode holder for searchlights. Frank R. House, Baldwin Harbor, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,051,377)

Snap fastener stud. Walter I. Jones, Arlington, Mass., assignor to United-Carr Fastener Corp. (2,051,407)

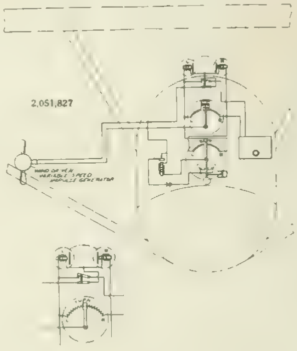
Sliding door. Anthony Henry Richard, Alexandria, La. (2,051,421)

Friction disk brake. Moses M. McCumber, Seminole, Okla. (2,051,566)

Airplane seat. Randolph F. Hall, Rochester, N. Y. (2,051,703)

Flying machine. Claude Dornier, Friedrichshafen, Germany. (2,052,086)

Aural flying. Luis de Florez, New York, N. Y. (2,051,827)



Automatic control arrangement for aircraft. Eduard Fischel, Berlin Templehof, Germany, assignor to Siemens Apparate und Maschinen Gesellschaft mit beschrankter Haftung. (2,051,837)

Method of treating berrylium and its alloys. Charles H. Monroe and Harry C. Claflin, St. Clair, Mich., assignors to The Berrylium Corp. (2,051,963)

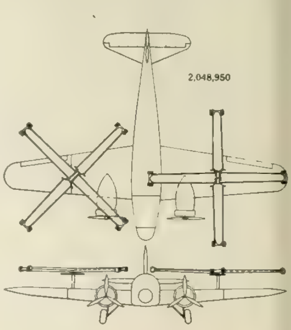
Airplane wheel. Gerald H. Cassady, Detroit, Mich., assignor by mesne assignments to United States Rubber Co. (2,052,130)

Spherometer. Horace H. Willis, Pelham, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,052,153)

Airplane flotation device. Daniel Mapes, Upper Montclair, N. J., assignor to Walter Kidde & Co., Inc. (2,052,186)

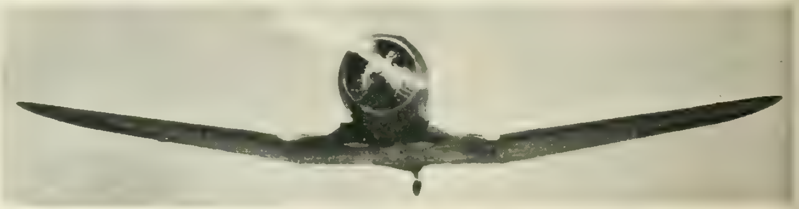
Supercharging device for internal combustion engines. Edvin Ossian Parcival Thege, Stockholm, Sweden, assignor to Aktiebolaget Atlas Diesel. (2,052,198)

Aircraft lift rotor and rotor pack. William John Roepke, Los Angeles, Calif. (2,048,950)



Airplane having variable lifting surfaces. Jacques Gerin, Boulogne-sur-Seine, France. (2,049,006)

Vought V-143 Pursuit Fighter



● The Materiél Division of the U. S. Army Air Corps at Wright Field recently completed tests on a new low-wing single seat fighter developed by Chance Vought Aircraft from original designs by the Northrop Corp. Known as Model V-143, the all-metal monoplane is characterized by high performance, low landing speed and adaptability for the installation of engines ranging from 525 to 700 hp.

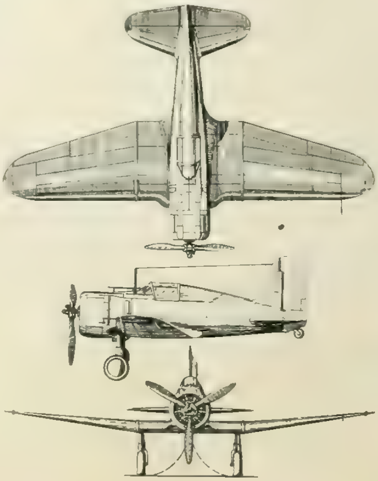
Design features contributing to Model V-143's performance include retractable landing gear, wing flaps and cowl flaps for controlling engine cooling within the proper limits, as well as a Hamilton Standard controllable-pitch propeller which may, optionally, be replaced by the constant speed propeller.

Fuselage construction is of the stressed skin, semi-monocoque metal type with a welded tubular steel engine mount. In the design of the cockpit, attention has been given to the pilot's comfort and convenience. The pilot is located as far forward as possible, having practically unlimited vision ahead; a transparent sliding enclosure affords protection from wind and weather.

Wings are full cantilever, of all-metal monocoque structure and consist of a center section and two outer panels. Ailerons are fabric covered and aerodynamically and dynamically balanced. Flaps are incorporated in the trailing edge of the wing and are hydraulically controlled by the pilot from the cockpit.

Full cantilever construction is utilized in the tail unit, fixed surfaces being all-metal. Elevators and rudder are metal structure fabric covered. They are dynamically and aerodynamically balanced as well as having trimming tabs controllable from the cockpit.

The full cantilever landing gear is of the single oleo strut type, and is completely retractable by hydraulic control. Wheels are equipped with 27-in. streamline tires; foot brakes are hydraulically operated and a parking brake is provided. The tail wheel is fully swivelling through 360° and can be locked in the trailing position from the cockpit.



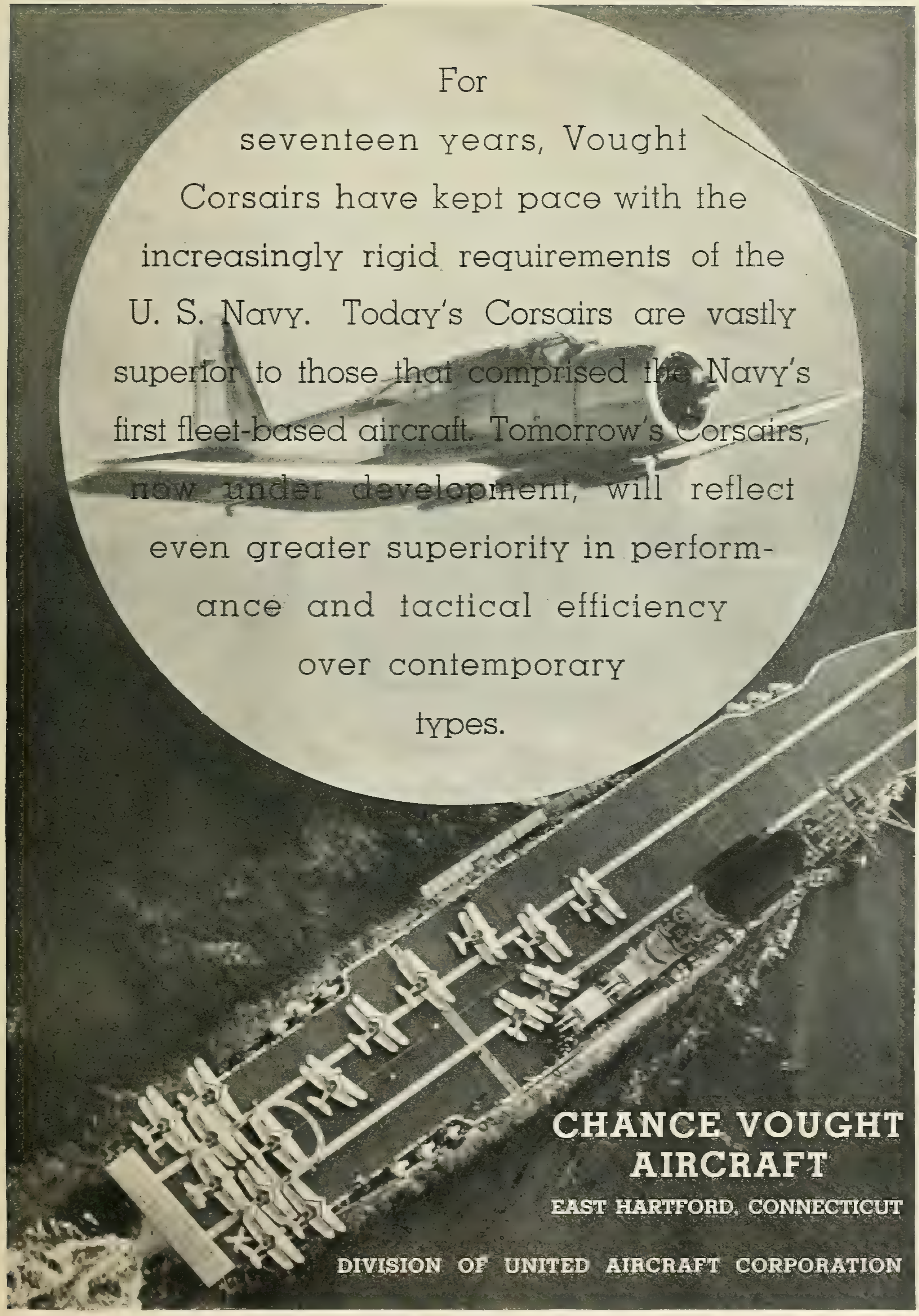
Outlines of the Vought Pursuit

Optional power plants include the P & W Wasp Junior engine which is geared 3:2 and rated 525 hp at 8000 ft., and the 700 hp Twin Wasp Junior engine which provides superior performance. Two aluminum alloy fuel tanks with a total capacity of 112 gals. and a welded aluminum alloy oil tank for 11.5 gals. are provided.

Armament consists of two fixed .30 calibre guns, synchronized to fire through the propeller disc, with 500 rounds of ammunition for each gun. Optional installation provides for .50 calibre guns. Provision is made for bomb racks capable of carrying a maximum of 300 lbs. of bombs, for camera gun, radio, oxygen apparatus and other equipment for special missions.

Specifications and performances (at 8000 ft.) of the Model V-143 with the Pratt & Whitney Wasp Junior engine are as follows:

Wing span	33 feet 6 inches
Height overall	9 feet 3 inches
Length overall	22 feet 4 inches
Wing area	187 square feet
Empty weight	3096 pounds
Useful load	964 pounds
Gross weight	4060 pounds
Wing loading	21.8 lbs./sq.ft.
Power loading	7.74 lbs./hp
Maximum speed	250 miles per hour
Cruising speed (75% power)	220 mph
Cruising speed (50% power)	186 mph
Landing speed	60 miles per hour
Service ceiling	28,000 feet
Cruising range	770-1070 miles



For seventeen years, Vought Corsairs have kept pace with the increasingly rigid requirements of the U. S. Navy. Today's Corsairs are vastly superior to those that comprised the Navy's first fleet-based aircraft. Tomorrow's Corsairs, now under development, will reflect even greater superiority in performance and tactical efficiency over contemporary types.

CHANCE VOUGHT AIRCRAFT

EAST HARTFORD, CONNECTICUT

DIVISION OF UNITED AIRCRAFT CORPORATION

The Folkerts Special Racer

Flown by Harold Neumann at Los Angeles

●

FREDERICK KNACK

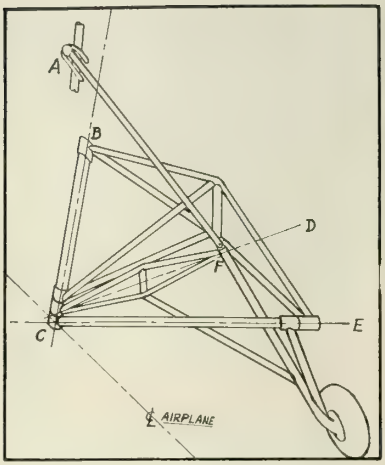


Diagram of retractable wheel

● Compiling an impressive record of wins at the National Air Races, the Folkerts Special flown principally by Harold Neumann became one of the outstanding racers on the field by reason of its two first places, two seconds, and a fourth, although this was the first meet in which it was entered.

Designed by Clayton Folkerts of Waterloo, Ia., it is a midwing monoplane powered by a 4-cylinder 185 hp Menasco *Pirate* engine. Slightly larger than other racers in its class, this ship is distinguished by a long, graceful fuselage and cantilever wing and tail surfaces. The wing is tapered, the ratio of root chord to tip chord being 2:1. Other features are the cantilever landing gear which retracts into the fuselage, and wing flaps.

The wing is of monospar construction. The single spar, a built-up spruce I-beam with narrow web and wide flanges is continuous from tip to tip and is designed to carry the shear and bending stresses. Ribs have plywood webs and spruce cap strips, with spacing being 6″ to 8″.

Horizontal stabilizer has two spruce spars and, like the wing, is plywood-covered. The vertical fin is built integral with the fuselage, structural members being welded chrome molybdenum steel tubing. It is fabric-covered, leading edge contour being maintained by balsa fairing. Elevators and rudder are steel tube structures, fabric-covered.

Aft of the engine mount, the fuselage is triangular in section, with the apex of the triangle at the bottom. This form of construction enables wheel retraction, and also permits better fairing of the fuselage aft of the cockpit. By having the base of the triangle at the top, a broad base is afforded for the attachment of wing and tail surfaces. Engine bearers and top longerons form a straight line from nose to tail. With tail and wing resting on the longerons, the thrust line is almost coincident with the chord lines of the wing and tail.

Landing gear is of the cantilever type arranged to fold entirely into the fuselage. As will be seen by the accompanying sketch, when the gear is locked in the landing position, the wheel rotates about the axis BC. This axis is not perpendicular to the plane of symmetry of the airplane, but slopes slightly forward. Rotation about axis is controlled by the shock cord at A, which is above and outboard of C.

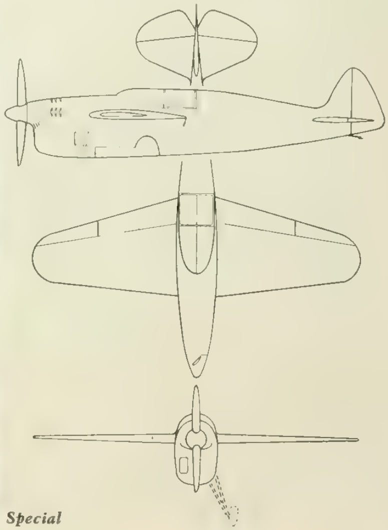
To understand the sketch, it should be said that the wheel is supported by a tripod of struts, the principal strut running to F, where it is hinged to the shock strut member AF. F is connected to the fuselage structure through the truss CF and is also locked to the floating truss BF when the gear is in position for landing. The side brace member of the chassis attaches to the center of truss CF.

Design of the landing gear is such that the principal strut bears the brunt of the load. In the normal three-point landing attitude, a slight tension load is produced in the drag strut, which gives a downward acting force at E, so that even should the lock at F fail, the system would still be stable. Should the load in the drag strut be compression, truss BE tends to rotate about axis BC, and is restrained by the shock strut AF acting through the lock at F.

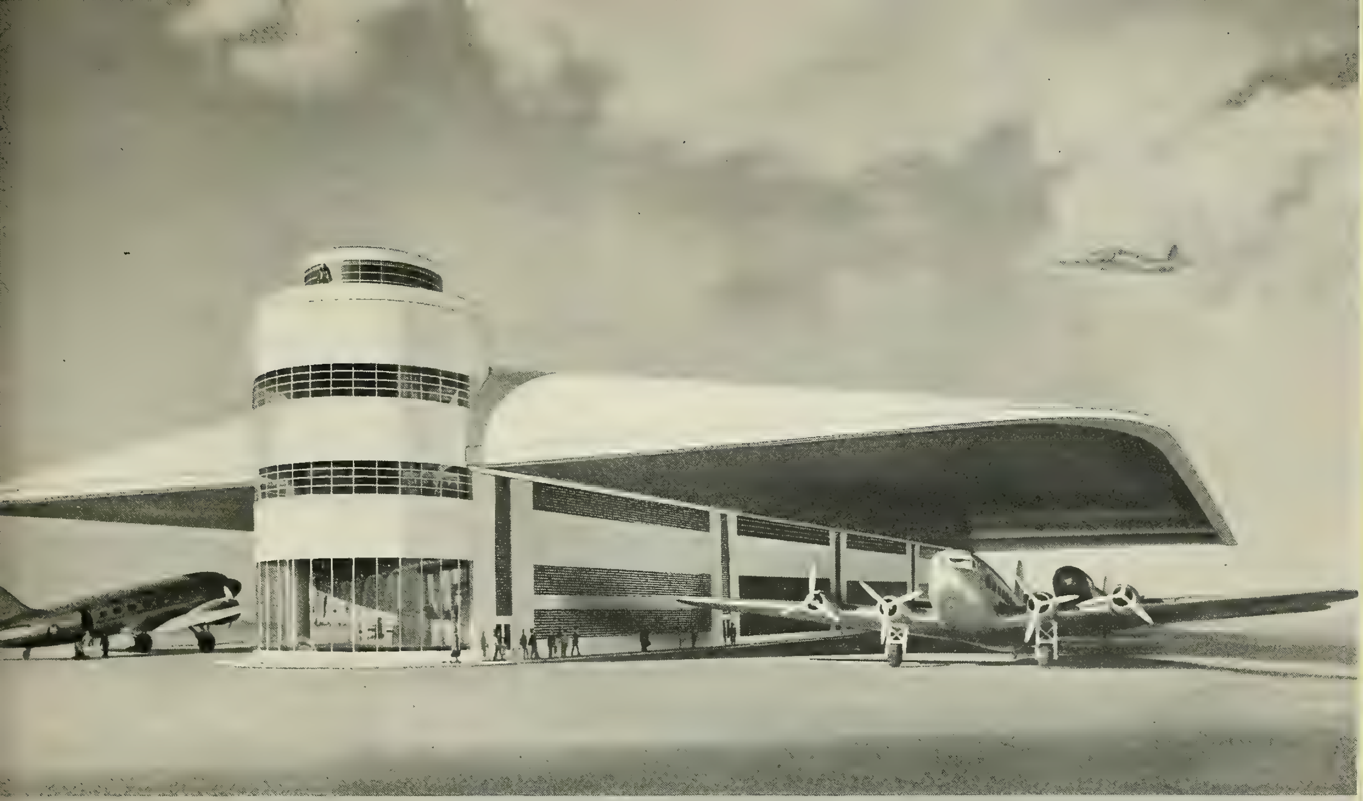
To raise the gear, it is necessary to release the catch at F and turn a crank in the cockpit which through an equalizer set of pulleys hauls the gear up into the fuselage. In doing this, the gear rotates about what might be called an imaginary axis through CF. CE, through hinges at C and E, permits the truss BE to move up with the chassis. As it goes up, the gear strikes a lever (not shown in the sketch) which brings up the doors to close the opening. As the doors go up, they strike another connecting rod, broken midway of its length by an eccentric joint, so that it is thrown past its neutral position and positively locks the gear in the retracted position, until released by the pilot.

In the up position, the 5″ × 12″ wheels

(*Continued on page* 102)



Engine installation and outlines of the Folkerts Special



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Cement	*by Medusa*
Modern Steel Sash . .	*by Truscon (Republic Steel)*
Glass Block	*by Owens-Illinois*
Structural Steel Shapes	*by Carnegie*
20-Yr. Bond Roof . .	*by Barrett*
Paints	*by DuPont*
Boilers	*by Babcock & Wilcox*
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Unit Heaters	*by Modine*
Lighting Fixtures . .	*by General Electric*
Pipe	*by Republic Steel*
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EQUIPMENT and METHODS

Anti-Corrosive for Incandescent Lamps

Bases of incandescent lamps used for outdoor flood lighting and similar purposes tend to corrode in their sockets after exposure to the weather. Frequently in attempting to unscrew such a lamp the bulb is separated from its base.

This can be overcome by applying to the threaded portion of the lamp base an aqueous suspension of colloidal graphite, which in water not only forms on solids, tenacious and homogeneous films of graphite, which are both unctuous and electrically conductive, but also films which are efficient dry lubricants and anti-corrosive agents.

Colloidal graphite is applied by spraying or brushing after grease-like substances have been cleansed from the surface. Lamp bases and fuse plugs of both the screw and cartridge types, so treated with graphite, should not be used until the films have dried thoroughly.

Insulated Loop Antenna

Experiments conducted by TWA with the loop antenna indicate that reception under conditions of rain, dust or snow was effected by static at high speeds and that reception improved considerably and proportionately with decrease in speed.

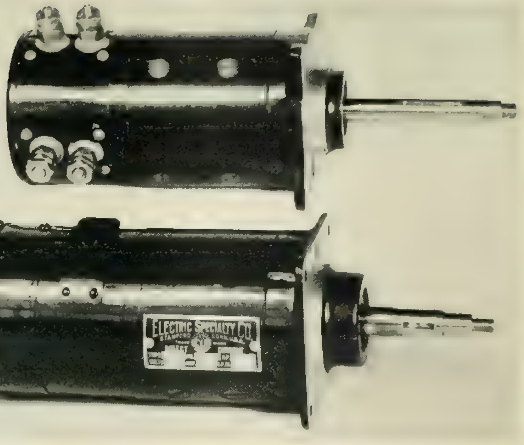
Under the direction of J. C. Franklin, chief of communications of TWA, radio engineers of that company developed a new shielding process for the loop antenna that largely has overcome inefficiency in reception caused by static, thus improving operation of the direction finders which are now being installed in the company's Douglases.

Spray Gun

Manufacturers, repair and service stations will be interested in the type MM spray gun now being marketed by the Paint Spray Equipment Division of Alexander Milburn Co. Possessing sturdy construction and producing results that are quick, accurate and variance-free, the device is useful for any painting operation, either with synthetics or emulsions, and particularly for wide, perfectly atomized spray work.

Standard air hose connection at the base of the handle is easily handled and neither tangles nor obstructs adjustment controls. Atomizer head is one-piece, precision machined and concentrically centered on fluid nozzle. Two-finger grip trigger operates against a non-corrosive ball bearing in the end of the air valve stem assuring frictionless operation. Fluid nozzle is wear-resisting steel with internal and external tapered seats, hardened and burnished.

A knurled adjusting nut operates a non-corrosive needle valve to regulate air flow to the atomizer head. This controls the volume of the spray and its shape, whether flat or round. Another knurled nut adjusts fluid flow by a stainless steel needle valve which is connected by a universal joint for constant alignment and easy replacement. This valve is closed by a tension spring which provides perfect seating under high fluid pressures.



Electric Specialty's new light-weight motors for use in operation of aircraft landing gears and wing flaps

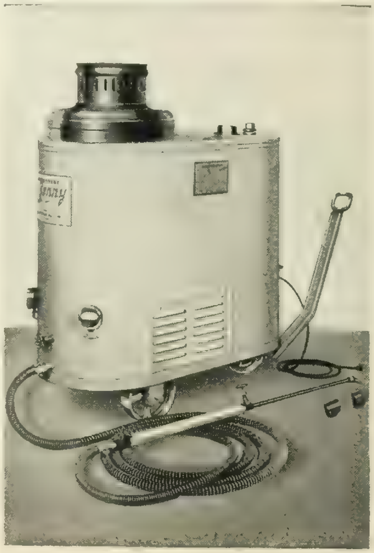
Motors for Flaps and Landing Gears

Two new motors have been produced by Electric Specialty Co. especially for use in the electrical operation of the wing flaps and retractable landing gears. Being designed for aircraft use solely, these motors feature light weight, compactness and reliability.

The units operate from the storage battery of the plane and due to the comparatively low input current and short time operation cause but little drain on the battery. Flange mountings to fit the pump for hydraulic operation of the landing gear and to fit the gear unit for operation of the flaps assure light weight, rugged and compact units.

Commutators are provided with a large number of segments and brushes of special composition intended to minimize frequent brush replacement and commutator wear. Easily removable shutters provide complete protection of commutator and brushes and at the same time permit easy access for inspection and cleaning. The over-size terminals may be mounted radially and exposed, or axially and protected with removable shutters.

Model E Hypressure Jenny designed for aeronautical usage



Heavy Duty Cleaning Unit

Homestead Valve Manufacturing Co., manufacturers of steam cleaning equipment for the aviation and other industries announce a new heavy-duty cleaning unit.

This unit, known as Model E *Hypressure Jenny,* was developed after research and development work on the requirements for aeronautical cleaning. It is recommended for cleaning engine blocks, fuselage, wings and general work around shops and buildings.

In use, Model E utilizes a mixture of vapor, hot water, soap or a selected chemical, and pressure. Being fully-contained it carries its own fuel tank, water and solution tanks, oil burner, and vapor generator.

Simplicity of operation is a feature. The equipment does not require a licensed engineer or a skilled mechanic. All that is needed to place it in operation is a line to the water tank and an electric connection. The unit is set in motion by an electric switch, water and solution being pumped from their respective tanks and automatically mixed to a predetermined proportion enroute to the generator coils, where the solution is heated. By turning a valve on the cleaning gun, a vapor spray emerges from its nozzle with high velocity, which combined with the reaction of the heated cleaning solution, breaks up accumulation of grease, dirt, or whatever material is being removed.

A new feature of Model EH (which is identical in size and appearance to E) is that two operations can work simultaneously from the one machine. This has been made possible by the addition of a second cleaning gun connection and by increasing the unit's pressure and general capacity.

AVIATION IS READY

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Aviation is out of its swaddling clothes. Today this great industry that circles the globe is demanding men—plenty of them—but ONLY men TRAINED to FIT the job. Aviation's barnstorming days are gone, to become an important part of this great Industry you must know more than how to fly or overhaul an engine. SPARTAN training will put you in Aviation, because SPARTAN from one of the most modern airplane factories to approved repair station is IN Aviation. Once you have investigated SPARTAN facilities, equipment and training YOU too, will be a member of the DAWN PATROL—the coupon will bring you the facts!

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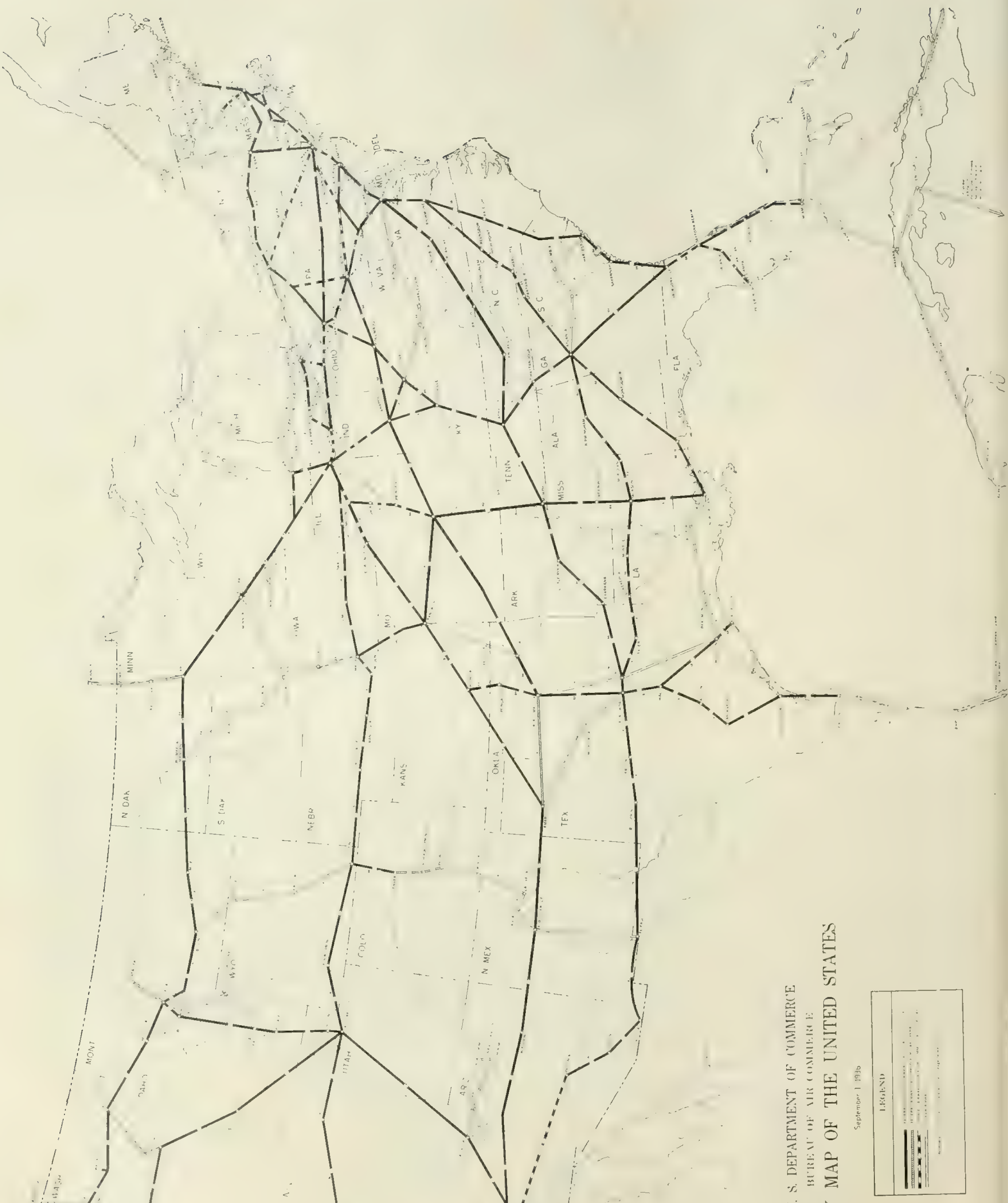


U. S. DEPARTMENT OF COMMERCE
BUREAU OF AIR COMMERCE

AIRWAY MAP OF THE UNITED STATES

September 1, 1936

DIRECTORY OF AMERICAN AIRLINES

American Airlines, Inc.,
4848 W. 63rd St., Chicago, Ill.
C. R. Smith, pres.; Ralph S. Damon, vice-pres. in charge of operations; T. J. Dunnion, vice-pres. & treas.; M. D. Miller, vice-pres. & sales mgr.; Wm. Littlewood, chief engineer; Hugh L. Smith, operations mgr.; O. H. Hamm, purchasing agent; H. D. Ingalls, supt. of maintenance.
Bases and Managers:
Maintenance: Glendale (H. B. Taylor); Ft. Worth (Frank Ware); Cleveland (Joseph Healey); Newark (W. C. Ray); Boston (E. W. Keeler); Chicago (F. J. Hoyt).
Equipment:
Douglas DST (8); Douglas DC-3 (12); Douglas DC-2 (15); Stinson Model A (14); Vultee V-1A (10).

Braniff Airways, Inc.,
Oklahoma City, Oklahoma
T. E. Braniff, pres.; Walter Lybrand, vice-pres.; Stuart Bailey, asst. to pres.; C. E. Beard, traffic mgr.; D. C. Walbridge, operations mgr.; W. M. Clough, purchasing agent; S. E. Perry, maintenance mgr.
Bases and Managers:
Maintenance: Chicago (Jack Brough); Kansas City, Mo. (John Cunningham); Brownsville, Tex. (Chas. Wolber). Maintenance and operating headquarters, Dallas.
Equipment:
Lockheed Electra (7); Lockheed Vega, reserve only (3); Stinson Reliant (1); Ford, reserve only (2).

Central Airlines, Inc.,
Pittsburgh, Pa.
J. D. Condon, pres.; D. Walter Swan, vice-pres. in charge of traffic; C. A. Clarke, treas.; J. F. Martin, operations mgr.; L. Harris, maintenance mgr.
Bases and Managers:
Maintenance: Detroit City Airport (L. Harris).
Operations: Cleveland Municipal Airport (J. F. Martin).
Equipment
Stinson Model A (5).

Chicago & Southern Air Lines,
Lambert Field, St. Louis, Mo.
Carleton Putnam, pres.; D. D. Walker, vice-pres. & traffic mgr.; B. E. Braum, operations mgr.; J. Young, purchasing agent; R. L. Anderson, maintenance mgr.
Bases and Managers:
Maintenance: St. Louis (R. L. Anderson).
Operations: Chicago (R. C. Cowles); New Orleans (T. C. Hatten).
Equipment:
Lockheed 10B (4); Pitcairn (1); Stearman (1); Stinson Jr. (1).

Delta Air Lines,
Selman Field, Monroe, La.
C. E. Faulk, pres.; M. S. Bledenharn, vice-pres.; C. H. McHenry, sec.; Travis Oliver, treas.; C. E. Woolman, gen. mgr.; P. L. Higgins, operations mgr.; Laigh C. Parker, gen. traffic mgr.
Equipment:
Lockheed Electras and Stinson Model A trimotors.

Eastern Air Lines,
1775 Broadway, New York, N. Y.
J. H. Kindleberger, pres.; E. V. Rickenbacker, vice-pres.; Paul H. Brattain, traffic mgr.; S. L. Shannon, operations mgr.; J. H. Brock, purchasing agent.
Bases and Managers:
Atlanta (H. F. Hershey); Baltimore (G. M. Dyson); Camden (S. R. Smith); Charleston (W. E. Beach); Chicago (E. G. Baringer); Indianapolis (R. J. Litteer); Jacksonville (D. J. McDearmid); Louisville (S. A. Kerr); Miami (G. C. Smith); Mobile (O. N. Barney); Montgomery (W. O. Foote); Nashville (A. S. MacCreadie); New Orleans (H. W. Tofflemire); Newark (C. N. Scully); Raleigh (J. F. Delk); Richmond (H. J. Polly); Savannah (W. D. Bennett); Spartanburg (J. E. Simkins); Vero Beach, Fla. (W. B. Holman); Washington, D. C. (E. G. Cross); Winston Salem (M. A. McDaniel).
Equipment:
Pitcairn Mailwings (2); Curtiss Condor T32 (6); Douglas DC-2 (14); Lockheed Electra (5).

Hanford Airlines, Inc.,
Kansas City, Missouri
A. S. Hanford, Sr., pres.; T. F. Ryan, 3rd, exec. vice-pres.; J. W. Miller, vice-pres. & gen. mgr.; M. L. Boss, traffic mgr.; W. N. DeWald, operations and maintenance mgr.; Norman Barker, purchasing agent.
Bases and Managers:
Kansas City, Mo. (J. W. Miller); Sioux Falls, S. D.
Equipment:
Lockheed Electra (2); Lockheed Vega (6); Ford tri-motor (2).

National Airways, Inc.,
Municipal Airport, Boston, Mass.
Paul F. Collins, pres.; S. J. Solomon, vice-pres.; J. V. Sheehan, traffic mgr.; C. B. Belinn, chief eng. and purchasing agent: M. H. Anderson, operations mgr.; C. M. Belinn, maintenance mgr. Boston-Maine Airways, Inc.: D. C. Douglass, pres.; L. F. Whittemore, vice-pres.; W. O. Wright, traffic mgr.; J. V. Sheehan, gen. passenger agent. Central Vermont Airways, Inc.: S. J. Hungerford, pres.; Edmund Deschenes, vice-pres.; J. B. Wood, sec. & treas.; T. E. P. Pringle, traffic mgr.; J. V. Sheehan, gen. passenger agent.
Bases and Managers:
Boston (P. N. Littlefield); Portland, Me. (M. Smith); Augusta (Wm. Eaton); Waterville (Wesely Marden); Bangor (W. Smith); Bar Harbor (Charles Rollins); Manchester (R. Swain); Concord (C. Marstev); White River Jct., Vt. (Morris Bugbee); Montpelier (J. Garcia); Burlington (Kenneth Partlow).
Equipment:
Stinson tri-motored (4); Lockheed Electra (3).

National Airlines System,
St. Petersburg, Fla.
G. T. Baker, pres.; R. U. Baker, traffic mgr.; P. Hubert, chief engineer, operations and maintenance mgr.
Equipment:
Stinson Airliners U (3).

National Parks Airways, Inc.,
Salt Lake City, Utah
Alfred Frank, pres.; Walter C. Lewis, vice-pres.; E. Y. Wells, traffic mgr.; A. W. Stephenson, operations mgr.
Bases and Managers:
Operations: Butte, Mont. (F. E. Tobin); Salt Lake City (Arthur Thomas); Great Falls, Mont. (Ray Ellinghouse).
Equipment:
Boeing 247-D (2). (Reserve) Boeing 80-A (1); Boeing 40-B-4 (1).

Northwest Airlines, Inc.,
St. Paul, Minnesota
L. M. Leffingwell, pres.; Croil Hunter, vice-pres. & gen. mgr.; F. W. Whittemore, vice-pres. and operations mgr.; K. R. Ferguson, traffic mgr.; E. I. Whyatt, sec. & treas.; Miles C. Cooper, purchasing agent; J. B. LaMont, supt. of maintenance.
Bases and Managers:
Seattle (C. A. DuRose); Billings (A. T. Petersen); Chicago (Craig Timmerman).
Equipment:
Lockheed Electra (12).

Pan American Airways System,
135 E. 42nd St., New York, N. Y.
J. T. Trippe, pres. & gen. mgr.; E. E. Wyman, asst. to pres.; G. L. Rihl, vice-pres.; R. G. Thach, vice-pres. & gen. Atty.; Evan E. Young and J. C. Cooper, Jr., vice-pres.; H. P. Morris, sec. & asst. gen. Atty.; A. A. Priester, chief eng.; V. E. Chenea, gen. traffic mgr.; H. C. Leuteritz, communication eng.; Franklin Gledhill, purchasing agent; L. L. Odell, chief airport eng.; W. I. Van Dusen, director of public relations. Eastern Division: W. O. Snyder, div. mgr.; M. J. Rice, regional director (Rio); Western Division: Erwin Balluder, div. mgr.; Pacific Division: Col. C. M. Young, div. mgr.
Equipment:
Martin Model 130 flying boats; Sikorsky S-40 and S-42 flying boats; Sikorsky S-43 amphibions; Fairchild amphibions; Douglas DC-2.

Pennsylvania Airlines,
Pittsburgh, Pa.
C. Bedell Monro, pres.; W. J. Austin, vice-pres.; W. S. Rosenberger, operations mgr. and purchasing agent; W. R. Manchester, maintenance mgr.
Bases and Managers:
Cleveland (W. R. Manchester); Washington, D. C. (M. A. Crowder); Detroit (C. A. Lupole); Milwaukee (J. J. Scholze).
Equipment:
Boeing Model 247 (6).

T.W.A., Inc.,
Municipal Airport, Kansas City, Mo.
Jack Frye, pres.; F. G. Wilson, vice-pres.; John B. Walker, traffic mgr.; Paul Richter, operations mgr.; F. G. Betts, purchasing agent; Walter A. Hamilton, maintenance mgr.
Bases and Managers:
Maintenance: Burbank (L. W. Goss); Columbus, O. (J. A. Collings); Newark (H. H. Gallup).
Operations: Kansas City, Mo. (W. A. Hamilton).
Equipment:
Douglas DC-2 (27); Ford tri-motor (4); Fleetster (5).

United Air Lines Transport Corp.,
221 N. LaSalle St., Chicago, Ill.
W. A. Patterson, pres.; Harold Crary, vice-pres. in charge of traffic and advertising; D. B. Colyer, vice-pres. in charge of operations; H. O. West, chief eng.; E. Van Vechten, purchasing agent.
Bases:
Cheyenne, Wyo.; Chicago, Oakland, Portland, Newark, Cleveland, Omaha, Salt Lake, Los Angeles, Seattle.
Equipment:
Boeing 247-D (46); Boeing 247 (6).

Varney Air Transport, Inc.,
P.O. Box 681, El Paso, Texas
Avery Black, pres.; J. E. Hart, vice-pres.; Roy L. Snyder, traffic mgr., purchasing agent and asst. gen. mgr.; J. E. Hart, operations mgr.; Al Notley, maintenance mgr.
Equipment:
Lockheed Vega 4).

Wedell-Williams Air Service,
Shushan Airport, New Orleans, La.
Mrs. H. P. Williams, pres.; E. D. Denis, vice-pres.; E. F. Newman, traffic mgr.; R. Brand, operations mgr., purchasing agent and sec.; E. Robertson, overhaul mgr.; L. N. Frosclair, service mgr.
Bases and Managers:
Patterson, La. (E. Robertson); New Orleans (L. N. Frosclair).
Equipment:
Lockheed Vega (4).

Western Air Express Corp.,
Burbank, California
Alvin P. Adams, pres.; C. N. James, vice-pres. and operations mgr.; Thos. Wolfe, traffic mgr.; D. M. Pattison, purchasing agent; J. T. King, maintenance mgr.
Bases and Managers:
Salt Lake City, Utah (F. Eastman); Las Vegas, Nev. (W. E. Bond); Burbank and San Diego, Calif.
Equipment:
Boeing 247-D (4); Stearman Model AD (1).

Wyoming Air Service, Inc.,
Casper, Wyoming
Dick Leferink, pres. & gen. mgr.; M. W. Landes, vice-pres. in charge of operations (Denver); E. B. Brown, sec.
Equipment:
Boeing 247.

SCHEDULED AIRWAY OPERATORS

Route No.	Operator	Routes Operated	Route Mileage	Class of Service
①	American Airlines, Inc	New York to Ft Worth (via Washington & Nashville)	1466	MPE
		Fort Worth to Los Angeles	1293	MPE
		New York to Chicago (via Buffalo & Detroit)	754	MPE
		Detroit to Chicago (via Kalamazoo)	263	MPE
		Chicago to St Louis	257	MPE
		Chicago to Fort Worth (via Peoria St Louis, Tulsa & Okla City)	950	MPE
		New York to Boston (via Hartford New Haven & Providence)	219	MPE
		Boston to Cleveland (via Albany & Buffalo)	637	MPE
		Cleveland to Nashville (via Columbus & Louisville)	469	MPE
		Washington to Chicago (via Cincinnati & Indianapolis)	684	MPE
		New York to Montreal	332	MPE
②	Braniff Airways, Inc	Chicago to Kansas City	410	MPE
		Chicago to Dallas (via Kansas City, Wichita & Oklahoma City)	964	MPE
		Amarillo to Fort Worth	315	MPE
		Dallas to Brownsville	546	MPE
		Waco to Galveston	206	MPE
		Houston to Corpus Christi	186	MPE
③	Central Airlines, Inc	Washington to Detroit	469	MPE
④	Chicago&Southern Air Lines,Inc	Chicago to New Orleans (via Peoria)	872	MPE
⑤	Condor Air Lines	Oakland to Salinas	100	PE
⑥	Consolidated Airlines	Oakland to Sacramento	80	PE
⑦	Delta Air Corporation	Charleston, S C to Dallas	1065	MPE
⑧	Grand Canyon Airlines, Inc	Las Vegas to Grand Canyon	269	PE
⑨	Hanford Airlines, Inc	Minneapolis to Omaha (via Sioux Falls)	361	MPE
		Omaha to Tulsa	383	MPE
		Bismarck to Sioux Falls	315	MPE
⑩	National Air Line System	St Petersburg to Jacksonville (via Daytona Beach)	237	MPE
⑪	National Airways Inc	Boston to Bar Harbor	253	MPE
		Boston to Burlington	193	MPE
⑫	National Parks Airways, Inc	Salt Lake City to Great Falls	489	MPE
⑬	North American Aviation, Inc (Eastern Air Lines Division)	New York to New Orleans (via Atlanta)	1296	MPE
		New York to Miami (via Charleston, S C)	1144	MPE
		Chicago to Miami (via Jacksonville, Louisville & Nashville)	1267	MPE
⑭	Northwest Airlines Inc	Chicago to St Paul (via Rochester & Milwaukee)	416	MPE
		Chicago to Pembina (via Milwaukee)	769	MPE
		Fargo to Seattle	1250	MPE
		Pembina to Winnipeg	65	PE
⑮	Pan American Airways Inc	Miami to Havana	225	MPE
		Miami to San Juan	1160	MPE
		San Juan to Paramaribo	1339	MPE
		Paramaribo to Buenos Aires	4652	MPE
		Miami to Belize (via Merida)	968	MPE
		Miami to Cristobal (via Kingston & Barranquilla)	1722	MPE
		Barranquilla to Port of Spain	987	MPE
		Miami to Nassau	188	MPE
		Brownsville to Mexico City (via Tampico)	466	MPE
		Mexico City to Cristobal	1764	MPE
		San Francisco to Manila, P I (via Honolulu, Midway, Wake & Guam)	7990	ME
		Kingston to Port au Prince	304	PE
		Port au Prince to Santo Domingo	161	PE
		Belem (Para) to Manaos	852	PE
		Mexico City to Merida	530	PE
⑯	Pan American Airways, Inc. (Aerovias Centrales)	Los Angeles to Mexico City	1684	PE
⑰	Pan American Grace Airways, Inc	Cristobal, Canal Zone to Montevideo, Uruguay (via Santiago, Chile)	4497	MPE
⑱	Pennsylvania Airlines & Transport Company	Washington to Detroit	410	PE
		Detroit to Milwaukee	265	MPE
⑲	Seattle Victoria Air Mail, Inc	Seattle to Victoria	74	M
⑳	Transcontinental & Western Air, Inc	New York to Los Angeles (via Chicago, Kansas City & Amarillo)	2583	PE
		New York to Los Angeles (via Columbus, Indianapolis & Kansas City)	2555	MPE
㉑	United Air Lines Transport Corp	New York to San Francisco (via Chicago)	2647	MPE
		San Diego to Seattle	1161	MPE
		Seattle to Vancouver	119	PE
		Salt Lake City to Seattle (via Portland)	816	MPE
		Pendleton to Spokane	169	MPE
㉒	Varney Air Transport Inc	Pueblo to El Paso	519	MPE
㉓	Wedell Williams Air Service Corporation	Houston to New Orleans	329	MPE
㉔	Western Air Express Corp	San Diego to Salt Lake City	702	MPE
㉕	Wilmington Catalina Airline, Ltd	Wilmington to Avalon	31	PE
㉖	Wyoming Air Service, Inc	Cheyenne to Pueblo	199	MPE
		Billings to Cheyenne	380	MPE

M. MAIL P PASSENGER E. EXPRESS

EDITORIALS

"Everything is fixed for me to take off (for New York) at the first favorable opportunity after October 15. I shall fly to Croydon Airdrome (near London) at night, arriving in the morning, and start within twenty-four hours, weather permitting. As I enjoy life and have decided to die in bed at a ripe old age I would not attempt a fourth crossing of the Atlantic unless I were confident of success."—JAMES MOLLISON.

Corruption In High Places

● Our leading article this month is a detailed exposé of the "powers behind the throne" in the air mail contract cancellation scandal and other ramifications and manipulations engineered by prominent greedy individuals to the detriment of the trusting taxpayer and the aeronautical industry.

While aviation always has been and probably always will be linked with politics, the amazing extent to which New Dealers fastened themselves upon the industry will go down in history as the most audacious and brazen breech of trust unearthed in years. What sleek snakes writhed away to seek dark places as each stone of evidence was turned!

This story substantiates the accusations frequently made in Aero Digest that the "fraud and collusion" upon which it was claimed the air mail contract cancellations were based was merely a subterfuge and contrary to the real facts. Now comes the proof and with it a mass of interlocking evidence conclusively damning to a group of low-calibered profiteers entrenched in high places. Shameful enough is the picture, yet it seems incredible when one realizes it had the apparent endorsement of the President of the United States!

The facts revealed for the first time by the publisher of Aero Digest are but a few of the revolting episodes stumbled upon in following the devious and slippery paths of these "friends of the industry."

Repercussions Of The Air Races

● The National Air Races drew 300,000 spectators and were undoubtedly a financial success. In spite of this, they were a flop in more ways than one. More attention was paid to showmanship than to the proper conduct of the races themselves. Of course that is understandable since the Hollywood influence apparently permeated air race headquarters.

Regard for the crowd's comfort and convenience was sadly lacking; the seating arrangements, especially in the lower price class, were unusually bad; and the concession racketeering usually found only at small county fairs and carnivals was greatly in evidence.

The announcing was frequently bad and inaccurate, the low point being the unsporting criticism of the winning of the Thompson Trophy by a foreign plane; the show of poor sportsmanship and laxness of the race management in allowing the use of its public address system for criticism of a competing foreign pilot who was doing such a splendid racing job, is inexcusable. Americans pride themselves in their reputations for being good losers. This disregard for fair play has left an unpleasant impression of American pilots among unprejudiced Americans, to say nothing of the effect on foreign pilots.

The idea that the Caudron is the product of a subsidy is erroneous, Detroyat explaining that the plane was developed as a private endeavor without Government backing. No further proof that the plane is not a military development (as is contended) is needed than the fact that the plane has been offered for sale to a private pilot in this country.

Since we must have air races, let us have less stress on showmanship and more attention paid to aerodynamical advancement. And also a little more old-fashioned diplomacy between the race management and the competing pilots would have gone a long way to smooth over the rough spots always evident during the hectic days of the National Air Races.

Transatlantic Air Race

● The French Air Ministry has plans for sponsoring an international transatlantic air race to commemorate the tenth anniversary of the Lindbergh flight from New York to Paris. One million francs—a lot of money even in French currency—will go to the winner and two million francs in all will be divided among the first four who complete the flight.

The sentiment behind the event is admirable but it is questionable whether the results would justify the risks that must be taken in a venture of this kind; whether sufficient advancement to trans-ocean flying will accrue and whether ocean travel by air will be helped in proportion to the dangers involved.

Many pilots, spurred by the rich awards, will be impelled to make the attempt with insufficient experience or equipment unsuited to long over-water jumps. The Dole Flight in 1927 and its disastrous ending to many pilots is still a vivid memory. The proposed transatlantic race has many of the earmarks of the doleful Dole race.

Tremendous strides have been made since that race across the Pacific. Transoceanic flights are made on regular schedules across that same ocean. But if the French want to pay tribute to the man who first flew the Atlantic solo, there are other ways to choose less dangerous yet as spectacular.

"Flying Is My Job"

● Beryl Markham's challenge to North Atlantic weather earned success for a flight which, in a single-engined plane, without radio, must remain a dangerous adventure.

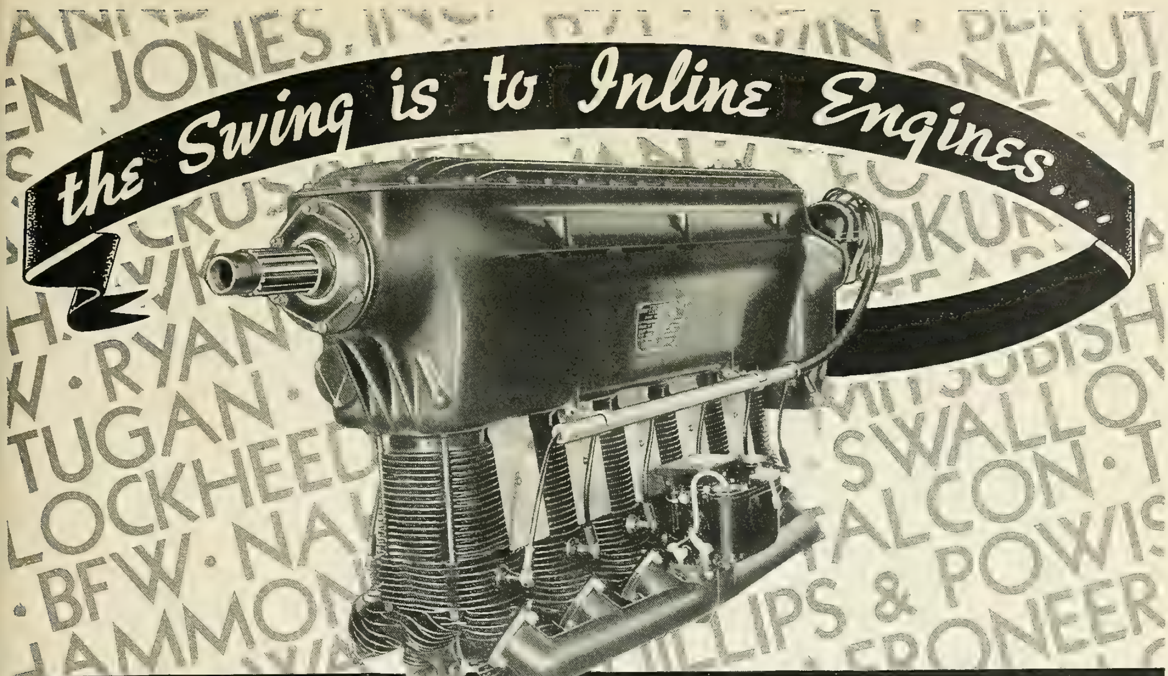
She not only accomplished the first westward crossing of the North Atlantic by a woman alone, but also set a new record for the longest feminine solo nonstop flight. In all she flew about 2700 miles.

There was nothing impulsive about her flight. For some time Mrs. Markham groomed herself and her plane for the crossing. "Flying is my job," she said, "and this Atlantic flight is part of it."

Her flight was magnificent, but in 1936 it cannot be regarded as a normal procedure for orderly progress in commercial aviation. The North Atlantic will not thus be conquered for the air mail and the passenger airplane. Yet the courage of the pilot, the skill with which she kept a perfect course across the ocean in spite of storms, and the determination that kept her going when still within range of a safe return, compel admiration if not approbation.

The flight of Merrill and Richman, while also terminating short of its announced goal, came closer to being a real "job." Yet in a single-engined plane, even though provided with the latest radio and navigational aids, the hazard was great.

Of the several trans-Atlantic flights made during the past month, the real "job" was that accomplished by the two German twin-engined Do-18 flying boats which are capable of flight on one engine, and can alight on the sea if necessary. This latter type of flying is the forerunner of regular trans-Atlantic airline service.



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Covers as no other book covers the whole attractive and important trade of the airplane mechanic. Thoroughly qualified and experienced men tell, in practical detail, what to do and how to do it. A book for student, beginner or experienced shop worker to study and to refer to at every opportunity. Clear, accurate, practical, and complete.

6" x 9". 493 pp. Illus.

$2.00

Write for Descriptive Catalog

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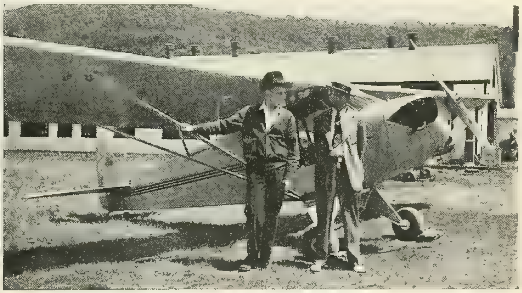
2 West 45th Street New York, N. Y.

THE NEW "CUB" IS SAFE • ECONOMICAL • STURDY • STABLE •

Buys his first New Cub in May . . .
Then another and another New **"CUB"**


Fred Larson, Jamestown, N. Y. (left) and one of his 3 New CUBs

First CUB earns $800 first three months

PAY JUST $490 CASH and Fly it home— ***EASY Monthly Payments***

IN MAY of this year Fred Larson, Jamestown, N. Y., with only a few dollars to his name, started a CUB Flying Club. Today he has a fleet of three New CUBs . . . busy most of the time. His first CUB has over 700 hours and it's still going strong. No repairs. No replacements, nor has either of his other busy CUBs.

Larson is *enthusiastic* about his CUBs. So is every other CUB owner, because it's low in price, yet high in quality; easy to buy and easy to fly; inexpensive to own and economical to operate. Students *like* to fly a CUB. The low cost of learning to fly in a CUB greatly increases the students . . . and the profits.

No wonder then, nearly 30% of *all* non-military aircraft made the first half of this year were CUBs! Present production of 3 CUBs a day promises to increase this overwhelming preference for the New CUB. Yes, now you may expect immediate delivery.

You too, can make money with a New "CUB".
TAYLOR AIRCRAFT COMPANY
No. 10 D Street, BRADFORD, Pennsylvania

CYDELITES ON THE NEWS

CY CALDWELL

● Senator Royal S. Copeland, Chairman of the Senate Air Safety Committee announces that the Committee convenes October 1 to see what has happened to the committee's report recommending reorganization of the U. S. Bureau of Air Commerce and to find out what, if anything, has been done to plow under the Director of Air Commerce. The Committee, you may recall, recommended the removal of Vidal and Martin, but made no recommendation about Colonel Cone, whom it apparently regards as an honest, conscientious individual who unluckily was thrust among unsavory companions.

When he returned recently from a vacation in Europe, Senator Copeland, according to the International News Service, said that he was surprised that no personnel shakeup had occurred in the Bureau during the past Summer. He hinted that the committee's recommendations for a cleanup in the Bureau were not being carried out because of politics.

Surely the good Senator must be mistaken when he even imagines—if he does—that politics plays any part whatever in the New Dealer's running of our great country. For it is Fuehrer Franklin Delano Roosevelt who bred this three-headed aeronautical monstrosity, and it is only Der Fuehrer who can dissolve it into its constituent elements of Vidal, Martin and Cone.

And this very thing, it is alleged in Washington, Der Fuehrer was about to do, when Jobmaster Jim Farley, the fellow who put F.D.R. where he is and is striving to keep him there, intervened. It is said that Vidal and Martin handed their resignations to Der Fuehrer on September 14, and that Col. J. M. Johnson, Asst. Secretary of Commerce, insisted that Cone likewise hand in his resignation. Upon receipt of these resignations, it is said, Der Fuehrer, through Daniel C. Roper, Secretary of Commerce, asked Fred D. Fagg, (Aeronautics Commissioner of the State of Illinois, Editor of the Law Journal and also instructor in Northwestern University) to accept the position of Director of Air Commerce, in lieu of the hydra-headed monstrosity, when and if deceased in due course.

While the triple-functioning Mr. Fagg was pondering all this, it is alleged, the Omnipotent Farley sniffed the political atmosphere from his humble lair at New York's Democratic National Headquarters, a modest shack inhabited largely by politicians seeking whom they may devour. One sniff, and honest Jobmaster James, the champion of the down-trodden proletariat, had his lackeys deposit his not quite proletarian baggage into a taxi, hold open the door for his non-proletarian bulk—for he is exceptionally well-fed, is James, with a fine round capon-lined belly,—and in a moment he was speeding off to Washington—by train, of course—to convince Der Fuehrer that decapitation of the aero-political monster should be deferred until after election. And there the matter rests.

So we may well question who runs the Department of Commerce,—Dan Roper, Der Fuehrer, or honest Jobmaster Jim, purveyor of panaceas to the proletariat.

● The National Air Races, unfortunately accounted for sundry mishaps and several new members in the Crash of the Month Club. Most serious injuries were suffered by Bennie Howard, less serious by his wife, Maxine, when their *Mister Mulligan* crashed in New Mexico—it is reported because of propeller failure. Our deepest sympathy, Bennie. Colonel Roscoe Turner was only slightly injured in the crash that completely wrecked his famous Wedell-Williams racing plane, but didn't even dent his dashing demeanor. His blue uniform survived the crash—nothing can disturb the built-in nonchalance of that gorgeous garment. S. J. Wittman's D-12 powered racer caught fire on the ground, was badly damaged. Art Davis, while testing the Conqueror-powered racer at 350 m.p.h. suddenly decided to go in for parachute jumping—of all things! The plane hit the ground long before Art did, and much harder.

Crashes during the races at Los Angeles destroyed or damaged planes flown by R. A. Kling, Joe Jacobson, and S. J. Wittman, none of whom were badly injured. Only Kling's plane was destroyed; the two others will be repaired. All crashed on the airport while landing after racing events.

Biggest loss was the Thompson Trophy race to France and a fine French sportsman named—perhaps as a courtesy to America—Monsieur Detroit. (That's how everybody pronounced it, anyhow.) Well, we give him credit.

Photos by Chas. F. McReynolds

Seen at the Air Races: The German Focke-Wulf and below it Gerd Achgelis inspecting the German Allenbaugh Special. At the right, Art Chester and Al Menasco. Lower right, R. A. Kling's "Suzy." Center, Louise Thaden, Blanche Noyes and Vincent Bendix

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● Amazing progress in man's gradual conquest of the air is reported from Norfolk, Virginia. The forward-thinking Mr. John H. Giesse, Chief of the Experimental or Advanced Thought Department of the Bureau of Air Commerce, is now experimenting with down-wind landings—a manner of alighting heretofore considered hazardous, even by birds. This is the same Giesse who was supposed to lay the golden $700 egg, the fool-proof airplane. He hasn't dropped it yet, although he has cackled a few times. But whenever we rushed to the nest, all we found was a china doorknob.

Now according to the Norfolk *Virginian Pilot,* it appears that this non-egg-producing Giesse and his 21-year-old son flew down to Virginia Beach to retrieve the charming Mr. 33⅓% Vidal.

Eyewitnesses of the epocha landing experiment, according to the *Pilot,* said that Mr. Giesse and his airplane made three valiant attempts to land on the field, each time coming in with the wind. The intrepid Giesse took the plane back up again after his first two experimental downwind landings, in which he touched the ground, rolled along swiftly, whipped up his horses and went around to try again. On the third noble experiment, unfortunately he overshot the field.

To quote the report directly "The plane's right wing ripped into an electric light pole carrying 220-volt wires, snapping the pole off at the base and crumpling the wing. The plane then grazed the top of the radio office" (apparently fumbling desperately for a Rex Martin radio beam)—"and struck the ground heavily, snapping off two water spigots and turning over on its back. It narrowly missed several U. S. Army planes at rest on the field, and came near to striking several fliers from Langley Field who have been using the field for base. William Burrall, commercial aviator, one of the first persons to reach the wrecked plane unfastened the safety belts of the two fliers and helped them from

(*Continued on following page*)

A Sensation as a money maker!

TED BROWN
AERONAUTICS
L. A. Municipal Airport (Mines Field)
Inglewood, California
Thornwall 1126 Night Hollywood 3521

Mr. T. Claude Ryan
Ryan Aeronautical Company
San Diego, California

August 26, 1936

Dear Claude:

Just to let you know how my Ryan S-T has been doing during the time I have had it in operation here at the Los Angeles Municipal Airport.

Student time has been running around 70 hours a month, and this time has been selling from $11.00 to $12.00 per hour. Everyone who has flown the ship likes it very much, and I am getting this price in competition with other ships here on the line with relatively the same horsepower getting as little as $5.00 per hour.

The upkeep is much less than any ship I have owned in this horsepower class, and the above time represents that sold to students.

With my business increasing due to the popularity
f my Ryan ship I expect to place an order for another
ip within the very near future and I will discuss this
th you on my next trip to San Diego.

With best regards, I remain

Yours very truly,

TED BROWN

What Ted Brown is doing, you can do. Flying equipment sells the customer. A Ryan S-T attracts and holds business like an electro magnet does steel. Its delightful flying qualities and low operating maintenance costs make it an ideal modern ship for the operator who is awake to opportunity. Profitably yours, RYAN AERONAUTICAL COMPANY, Lindbergh Field, San Diego, California.

Some valuable dealer territories are available to established firms on a new dealership proposition. Write on your company stationery.

Financing available on a basis of one-third down and balance over a year

RYAN
S-T SERIES

SCINTILLA
AIRCRAFT MAGNETOS

As standard ignition equipment, have helped in the establishment of the excellent service record of

BRANIFF
AIRWAYS

Miles flown during 1935 by Braniff Airways, 2,330,588; Passengers, 14,556; Mail 688,396 lbs.; Express 97,967 lbs.

SCINTILLA MAGNETO CO., INC.
(Subsidiary of Bendix Aviation Corporation)
SIDNEY, NEW YORK

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(*Continued from preceding page*)

the upside-down cabin."

The report concludes: "According to Mr. Burrall, Mr. Giesse made no explanation of how the accident happened. The field has two wind vanes, which clearly indicate the wind direction. Mr. Vidal inspected the wrecked plane but made no comment." He was apparently speechless. After all, it wasn't *his* airplane. The taxpayers once more foot the bill.

● In the State of Pennsylvania it is illegal to fly a ship unless it is licensed. Yet in order to get it licensed, you have to fly it first!—without a license. But if you fly without a license, for any purpose, you're breaking the law—and may find yourself in jail when the license finally arrives.

● The advantages of being an airline pilot were never better demonstrated than by TWA Pilot LaVerne W. Browne, whom the TWA Publicity Department describe in their release to all papers as "a fine looking and well set up individual who is still in his twenties." We are happy to learn that young Mr. Browne is well set up. This undoubtedly will prove a big help to him when he gets to Hollywood. Yes, Hollywood done got him—it gets all us good looking young fellows sooner or later—later, in my case. So far they've overlooked me—I can't understand it. In the well set up Mr. Browne's case, it seems that Mr. B. P. Schulberg, one of the merry moguls of moviedom, saw Pilot Browne while a passenger on a TWA ship. Just like that Mr. Schulberg saw a screen possibility in the handsome young pilot and Presto!—he was signed up to a movie contract. It just goes to show that if you really apply yourself in aviation you'll eventually get somewhere. I've always said so, haven't I?

LaVerne W. Browne

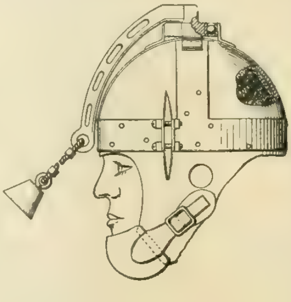
● I've just been looking over Karl Ort's catalogue; 608-640 West Poplar St., York, Pa., is the address. He sells everything having to do with flying, and I was needing a fly swatter. It's worth the dime he charges for it, just for his sales talks. For instance, about his Safety Belts he says: "You can buy Safety Belts from me far cheaper than you can anywhere else. There is nobody I would rather see buy some of these belts than you. There is nobody who would wish they had bought one more than you will if you ever try to push your schnozzle through the instrument panel or the cowling. Such accidents happen. Look in the mirror and try to imagine what your kisser would look like after wrapping the cowling around it. Then sit down and make up your mind quick that you would rather part with a buck or two for one of my good strong substantial safety belts instead of taking any chances with your good looks." About his flying suits he says: "If your blood circulates at all, and I certainly hope it does, this flying suit will surely keep you warm." and if you don't fly he says you can use it for duck hunting—he doesn't care. Furthermore, if you shove yourself inside one of his Winter Flying suits, he says, you can be nonchalant and undisturbed in any weather—except hot weather.

He's a card, Karl is. First time I met him was back in 1922 when he was flying around advertising cigars—five-centers—by scattering them over the land attached to tiny paper parachutes. The idea was to deliver the product, direct from the skies, into the hands of the consumer, who would smoke them, hot from the DH 6 in which Karl was staggering around, and then rush enthusiastically to the stores to buy them by the box, or even the crate. However, when no sales whatever resulted from this scheme, it finally dawned on the cigar manufacturer and on Karl that the kids whom they could see frantically chasing the descending parachutes weren't taking the samples home to papa. They were smoking them themselves.

● My good friend Wright Vermilya, Jr., President of Vermilya Aviation Sales of Hugh Watson Field, Sharonville, Ohio, officially notifies me that the depression *is* over, and proves it so far as he is concerned with a picture of a whole carload of Ryan S-T planes—five of them—valued at $22,000 which rolled up to his sales rooms recently. It is the first carload of airplanes to be received in Greater Cincinnati within the last seven years, and is the biggest single shipment received there since back in 1924, or thereabouts, when I went through from Dayton, Tenn., with a picture of the front of William Jennings Bryan, just after he had distended himself like a boa constrictor with the big dinner that killed him an hour later—he died of acute indigestion and annoyance at Clarence Darrow, who teased him in that Fundamentalist-Scopes monkey trial—remember? Ike Vermilya has sold ten Ryans this year, including all of this shipment of five.

● Suggested theme song for Joe Crane's parachute school at Roosevelt Field: "It Don't Mean a Thing If You Don't Pull That String."

● The accompanying drawing of the head attachment with swinging beam and weight in front of the wearer's nose comes—believe it or not, Mr. Ripley—from the U. S. Patent Office Official Gazette of Aug. 18, 1936. It illustrates patent No. 2,051,366, issued to one John H. Catron of Willow Glen, Calif.—evidently a very stimulating place for the imaginative. The device illustrated is a head and neck exerciser, apparently intended for stiff-necked or weak-headed folks, such as Congressmen, Senators, and Bureau of Air Commerce officials. The patient adjusts the harness to his head, swings or rotates his dome rapidly, and the weight attached to the front rotating bar bounces back and forth, jerking the neck and head into many startling and invigorating positions. Brains, if any, subjected to this rapid rotation may become even more addled than they were in the first place, which seems a very good thing, indeed. I mean, there's no comfort in being half goofy in a world that is entirely so. Rotate the head, and join those who vote for Roosevelt.



● Mr. Phil Lee, Jr., of Louisville, Kaintucky, Suh, has solved a hitherto baffling mystery about the British, our dear cousins across the sea—and you know what damned rascals everybody's relatives usually are. Says Mr. Lee. "Did it ever occur to you why it was that so much difficulty is experienced in trying to get the original Wright ship back to this country? It is not this Smithsonian squabble at all; that is just to cover up the real use to which this ship is put: The British engineers are stealing design features from it! Don't take my word for it; look at the airliners they've been building for the past decade. The average airline on the Continent ought to be a great market for used American equipment. Somebody ought to start like the Fuller Brush people and give 'em a free sample—a Condor or maybe just a Ford, for an introductory offer."

We're doing even better: we're selling brand new American transport planes everywhere in Europe. I understand Imperial Airways is going to buy Douglases to tow their English equipment as gliders. Now that war seems imminent, perhaps the European airlines will buy ALL American modern transports and send their own old crocks to the military training schools to be used as towed targets.

● A Spanish Loyalist pilot, Juan Balcello, left Barcelona on a fine August day to fly ammunition to government forces at San Sebastian. Lost and flying over France, according to the Associated Press, he ran low of gas, landed in a field near Toulouse, and asked some children to look after his cases of ammunition until he returned. He then flew to an airport and refueled, after his plane had been searched by the authorities, who of course found no ammunition. Neither did the pilot when he returned, for the children's parents had turned the cases over to the police. Disgruntled, the pilot flew away and wandered about private airports in the south of France, fearing punishment if he returned munitionless to Barcelona—in Spain they shoot a fellow before he's got half through his explanation of how he was so careless as to be a Spaniard in the first place. Finally this wandering pilot landed at Nice, France, where authorities seized his plane. When they turned to seize him, the pilot had disappeared. Thus he had lost his way, his cargo, his plane, and finally himself,—making a thorough job of it.

I see where the Spaniards have killed over a hundred thousand of themselves so far. The bulls must be getting a quiet feeling of satisfaction out of that.

● Knock, knock. . . . Who's there? . . . Vidal. . . . Vidal *who?* . . . Vy d' all the people knock knock the Bureau of Air Commerce?

INDEX TO THE MANUFACTURERS OF AIRPORT & AIRLINE EQUIPMENT

The following pages contain a directory of the sources of supply of airport and airline equipment used at airports. The listings are as complete as can be made with the information available. The accompanying Index indicates the manufacturers listed. Complete data relating to the companies is given in the Directory Section (pages 78 to 92) where manufacturers are listed alphabetically. Companies marked (A) are also listed in the April "Digest of Aircraft and Aircraft Engines"; those marked (Ja) are also listed in the January "Digest of Aircraft and Engine Machinery"; and those marked (Ju) are also listed in the June "Digest of Aircraft and Engine Materials."

AIR COMPRESSORS

American Engineer Company
Auto Compressor Company
Brunner Manufacturing Co.
Champion Pneumatic Machny. Co.
Curtis Pneumatic Machinery Co.
Dayton-Dowd Company
DeVilbiss Company
Gardner-Denver Company
Globe Air Compressor Company
Gould Pumps, Incorporated
Ingersoll-Rand Company
A. Schrader's Son
Sullivan Machinery Company
U. S. Air Compressor Company

AIR CONDITIONERS

Airtemp, Incorporated
Caldwell & Assn.
Carrier Engineering Corp.
Champion Pneumatic Mach. Co.
Delco Appliance Company
Frigidaire Corporation
General Refrigeration Sales Co.
Kelvinator Sales Corporation
Kleen Heat, Incorporated
H. H. Robertson Company
Spencer Heater Company
B. F. Sturtevant Company
Westinghouse Elec. & Mfg. Co.
Worthington Pump & Machny. Co.

AIR FILTERS

Marshalltown Manufacturing Co.

AIRLINE TICKETS

Dameron Pierson Co., Ltd.
Grocer Printing Company
LaRue Printing Company

AIRPORT SHOP EQUIPMENT

Air Associates, Inc.
American Chain Company, Inc.
Atlas Press Company
Binks Manufacturing Co.
Black & Decker Mfg. Co.
Bonney Forge & Tools Works
Burton-Rogers Company
Champion Penumatic Machny. Co
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Cleveland Twist Drill Co.
Coffing Hoist Company
Delta Manufacturing Company
DeVilbiss Company
Duro Metal Products Company
Fedders Manufacturing Co.
Greenfield Tap & Die Corp.
The Heald Machine Company
Lyon Metal Products, Inc.
The Alexander Milburn Co.
Northwest Air Service, Inc.
Paasche Airbrush Company
Peck, Stow & Wilcox Company
Pennsylvania Aircraft Syn., Ltd.
Plomb Tool Company
Robbins & Myers
Smith Acetylene & Welding Equip.
Snap-On Tools, Inc.
Speedway Manufacturing Co.
U. S. Electrical Tool Company
Valley Electric Corp.
Weaver Manufacturing Company
Westinghouse Elec. & Mfg. Co.
Yale & Towne Mfg. Company.

BAGGAGE TRUCKS

The Colson Corporation
Johnson Airplane & Supply Co.
Mercury Manufacturing Company
Karl Ort

BATTERY CHARGERS

John Bean Manufacturing Co.
Forest Electric Company
General Electric Company
Hobart Brothers Company
Interstate Electric Co.
Triple-A-Specialty Company
Valley Electric Corporation
Weidenhoff Manufacturing Co.
Westinghouse Elec. & Mfg. Co.

CLEANING EQUIPMENT AND MATERIALS

The Bon Ami Company
The Curran Corporation
Homestead Valve Mfg. Co.
Magnus Chemical Co.
F. E. Myers & Bro. Company
Noskrape Laboratories, Inc.
Oakite Products, Incorporated
Turco Products, Inc.

DE-ICING EQUIPMENT

Benson Ornamental Bronze and Lighting Co.
Eclipse Aviation Corp.
The B. F. Goodrich Co.

DOLLIES & WHEEL CHOCKS

OCS Manufacturing Company
Karl Ort

DRAINAGE PIPING

Armco Culvert-Mfrs. Assoc.
Carnegie-Illinois Steel Corp.
Denver Sewer Pipe & Clay Co.
Hancock Tile Company
Laclede-Christy Clay Products Co.
Nebraska Culvert & Mfg. Co.
Newport Rolling Mill Company
Walker Cement Products, Inc.
Wheeler Bridge & Lbr.

ELECTRICAL EQUIPMENT

Kellogg Switchboard & Supply Co.
Pass & Seymour
Pyle-National Company
Robbins & Myers

ELECTRICAL GENERATORS

Autonator Laboratories, Inc.
General Electric Company
Fairbanks, Morse & Company
The Kohler Company
United American Bosch Corp.
Westinghouse Electric & Mfg. Co.

FENCING

Acme Fence & Iron Company
Alamo Iron Works
American Chain Company
American Steel & Wire Co.
Anchor Post Fence Co.
Colorado Fuel & Iron Corp.
Continental Steel Corporation
Cyclone Fence Company
Standard Fence Company
Stewart Iron Works Co., Inc.
C. H. Tully Fence Company

FIRST AID EQUIPMENT

Bauer & Black
E. D. Bullard Company
Burroughs Wellcome & Co., Inc.
Davis Emergency Equipment Co.
Johnson & Johnson
Mine Safety Appliance Co.
M. L. Snyder & Son
Seabury & Johnson

FIRE FIGHTING EQUIPMENT

American-LaFrance & Foamite Industries, Inc.
Badger Fire Extinguisher Co.
Buffalo Fire Appliance Co.
C-O-Two Fire Equipment Co.
Dayton Fire Extinguisher Co.
Fyr Fyter Company
Garrison Engineering Corp.
General Fire Truck Corp.
Johnson Airplane & Supply Co.
Walter Kiddie & Company
The Phister Manufacturing Co.
Pyrene Manufacturing Co.
Stempel Fire Ext. Mfg. Co.
Washington Equipment Co.

FUELING SYSTEMS

Aqua Systems, Inc.
S. F. Bowser & Company
Columbian Steel Tank Co.
Gilbert & Barker Mfg. Co.
Motor Improvements
Pump Engineering Company
Steel Products Engineering Co.
Viele Valve Corporation

GRADING AND MAINTENANCE EQUIPMENT

Buffalo-Springfield Roller Co.
Caterpillar Tractor Co.
Detroit Harvester Company
Eversman Mfg. Co., Inc.
Flexrock Company
Ideal Manufacturing Co.
International Harvester Co.
Jacobsen Mfg. Company
Killifer Manufacturing Co.
Minn.-Moline Power Imple. Co.
W. A. Riddell Company
Toro Manufacturing Co.

HANGARS, HANGAR EQUIPMENT

Allith-Prouty Manufacturing Co.
Austin Company
Bennett Air Service
Blaw-Knox Company
Butler Manufacturing Co.
Carnegie-Illinois Steel Corp.
Columbian Steel Tank Company
Crouse-Hinds Company
Durabilt Steel Locker Co.
Esline Company
Hauenstein & Burmeister, Inc.
Ingalls Iron Works Co., Inc.
International Derrick & Equip. Co.
International Stacey Corp.
International Steel & Iron Co.
Lincoln Steel & Forge Co.
Lincoln Steel Works
Maryland Metal Building Co.
Midland Chemical Co.
F. E. Myers & Bro. Co.
Miss. Valley Structural Steel Co.
Muskogee Iron Works
Orange Car & Steel Co.
Richards-Wilcox
Roanoke Bridge & Iron Works
H. H. Robertson Company
Stefco Steel Company
James H. Tower Iron Wks.
Truscon Steel Co.
Virginia Bridge & Iron Co.
Western Pipe & Steel Company

HANGAR DOORS

American Rolling Mill Co.
American Sheet & Tin Plate Co.
Carnegie-Illinois Steel Corp.
Cornell Iron Works
Detroit Steel Products Co.
Esline Company
Hauenstein & Burmeister, Inc.
Ingalls Iron Works Co., Inc.
Muskogee Iron Works
Orange Car & Steel Company
Richards-Wilcox
Roanoke Bridge & Iron Works
Stefco Steel Company
Truscon Steel Company
Western Pipe & Steel Company

HANGAR HEATERS

American Blower Corp.
Amer. Heating & Ventilating Co.
American Radiator Co.
Autovent Fan & Blower Co.
Bryant Heater Company
Buffalo Forge Company
Clarage Fan Company
Delco Appliance Corp.
C. A. Dunham Company
Humphrey Company
Ilg Electric Ventilating Co.
Kewanee Boiler Corp.
Kleen Heat, Inc.
Modine Manufacturing Co.
Herman Nelson Corporation
Skinner Bros. Mfg. Co., Inc.
Spencer Heater Company
B. F. Sturtevant Company

INDEX TO THE MANUFACTURERS OF AIRPORT & AIRLINE EQUIPMENT

Trane Company
Utica Radio Corp.
U. S. Radiator Corp.
York Heating & Ventilating Corp.

LIGHTING EQUIPMENT

Bausch & Lomb Optical Co.
B-B-T Corp. of America
Bull Dog Electric Prod. Co.
Claude Neon Lights, Inc.
Hazard Insulated Wire Wks.
Intl. Derrick & Equip. Co.
Lakewood Engineering Co.
National Carbide Corp.
The Okonite Company
Rose Aviation Corp.

Beacons

Air Associates, Inc.
Air-Ways Equip. Corp.
American Gas Accumulator
Bartow Beacons, Inc.
Bausch & Lomb Optical Co.
Crouse-Hinds Company
General Electric Company
Lights, Incorporated
Pyle-National Company
Sperry Gyroscope Company
Westinghouse Electric & Mfg. Co.

Buoys

Jaeger Machine Company
Lights, Incorporated

Boundary Lights

American Airport Equip. Co.
American Gas Accumulator
Crouse-Hinds Company
Cutler-Hammer, Inc.
General Electric Company
Jaeger Machine Company
Martin Electric Company
Pyle-National Company
Westinghouse Electric & Mfg. Co.

Flood Lights

American Gas Accumulator
S. F. Bowser & Company
Crouse-Hinds Company
General Electric Company
Lights, Incorporated
Martin Electric Company
Pyle-National Company
Sperry Gyroscope Company
Westinghouse Electric & Mfg. Co.

Obstruction Lights

American Airport Equip. Co.
American Gas Accumulator
Crouse-Hinds Company
General Electric Company
Jaeger Machine Company
Pyle-National Company
Westinghouse Electric & Mfg. Co.

Runways Lights

American Gas Accumulator
Cutler-Hammer, Inc.
General Electric Company
Jaeger Machine Company
Westinghouse Electric & Mfg. Co.

Lighting Cable

American Steel & Wire Co.
Anaconda Wire & Cable Co.
General Cable Company
Hazard Insulated Wire Works
Kerite Insulated Wire & Cable Co.
John A. Roebling's Sons Co.
Westinghouse Electric & Mfg. Co.

LOCKERS

All-Steel-Equip Co., Inc.
Berger Manufacturing Co.
Charpiot Safe Company
Durabilt Steel Locker Co.
General Fireproofing Co.
Lyon Metal Products, Inc.
Fred Medart Mfg. Co.
OCS Manufacturing Co.
Penn. Metal Co. of Pennsylvania
Shaw-Walker Company
Terrells Equipment Co.

LUBRICATING EQUIPMENT

Lincoln Engineering Company
Stewart-Warner Corporation

MAPS

Rand McNally & Company

OFFICE EQUIPMENT

Intl. Business Machine Corp.
Remington Rand, Inc.
Shaw-Walker Company

PETROLEUM

American Oil Company
Associated Oil Company
Continental Oil Company
Crusader Oil Corporation
Ethyl Gasoline Corp.
Fiske Brothers Refining Co.
Garland Products Co., Inc.
Gulf Refining Company
Humble Oil & Refining Co.
Kendall Refining Company
Pennzoil Company
Phillips Petroleum Company
Pure Oil Company
Pyroil Company
Quaker State Oil Refining Co.
Richfield Oil Company of Calif.
Shell Eastern Pet. Products, Inc.
Shell Oil Company
Shell Petroleum Corporation
Sinclair Refining Company
Skelly Oil Company
Socony-Vacuum Company, Inc.
Stanavo Specification Board, Inc.
Texas Company
White Star Refining Company
Wolverine-Empire Refining Co.

PORTABLE STARTERS

Briggs & Stratton Corp.
Cleveland Pneumatic Tool Co.
Eclipse Aviation Corp.
Valley Electric Company

PUBLIC ADDRESS SYSTEMS

General Electric Company
Jensen Radio Manufacturing Co.
Operadio Manufacturing Co.
RCA Manufacturing Co., Inc.
Remler Company, Incorporated
Universal Microphone Co.

PUMPS

Blackmer Pump Company
S. F. Bowser & Company
Fairbanks, Morse & Co.
Hoffman Specialty Co.
Viking Pump Company
Worthington Pump & Mchy. Co.

Air

Curtis Pneumatic Machinery Co.
Ingersoll-Rand Company
Pump Engineering Service Corp.
Tokheim Oil Tank & Pump Co.
U. S. Air Compressor Company

Fuel

Butler Mfg. Company
Gilbert & Barker Mfg. Co.
Kraissl Company
Pump Engineering Service Corp.
Geo. D. Roper Corporation
Sharpesville Boiler Works Co.
Tokheim Oil Tank & Pump Co.
Wayne Company

Oil

Bennett Pump Corporation
Gilbert & Barker Mfg. Co.
Pump Engineering Service Corp.
Geo. D. Roper Corporation
Tokheim Oil Tank & Pump Co.

Power

F. E. Myers & Bro. Company

Sewage

Dayton-Dowd Co.
Goulds Pumps, Inc.

Sump

Goulds Pumps, Inc.
Pemberthy Injector

Water

C. H. & E. Manufacturing Co.
Chicago Pump Co.
Dayton-Dowd Company
Fairbanks, Morse & Co.
Goulds Pumps, Inc.
F. E. Myers & Bro. Company
Nash Engineering Company
Pomona Pump Co.
Wagner Steam Pump Co.
Westco Pump Corporation
Worthington Pump & Mchy. Corp.

Accessories

Ralph N. Brodie Company
The F. E. Myers & Bro. Co.

PURIFIERS

Goulds Pumps, Inc.

RADIO

Breting Radio Company
General Electric Company
Hammarlund Mfg. Company
Harvey Radio Laboratories
W. P. Hilliard Company
Lear Developments, Inc.
National Company, Inc.
Philco Radio & Television Corp.
Radio Frequency Laboratories, Inc.
Radio Navigational Instrmt. Co.
RCA Manufacturing Company
Simplex Electric Company
Western Electric Company
Westinghouse Electric & Mfg. Co.
Zenith Radio Corporation

SCALES

John Catillon & Sons
Fairbanks, Morse & Company
Triner Sales Company

SIRENS

E. D. Bullard Company
W. S. Darley Company
Federal Electric Co., Inc.
Sterling Siren Fire Alarm Co., Inc.

SPRINKLER SYSTEMS

Grinnel Company, Inc.
Viking Corporation

SURFACING MATERAL

Barber Asphalt Company
Barrett Company
Berry Asphalt Company
The Cement Institute
Cosden Oil Company
Gilmore Oil Company
Koppers Products Company
Portland Cement Association
Quigley Company, Inc.
Texas Company
Warner-Quinlan Company
Westinghouse Electric & Mfg. Co.

TRACTORS

Allis-Chalmers Manufacturing Co.
Baker Raulang Company
Caterpillar Tractor Company
Clark Tructractor Company
Cleveland Tractor Company
International Harvester Co.
Klauer Manufacturing Co.
Massey-Harris Company
Mercury Manufacturing Co.
Minn.-Moline Power Imple. Co.
Toro Manufacturing Company

UNIFORMS

S. Appel & Company
Craddock Company
Geiger's Men's Shop, Inc.
Gelhaar Uniform Company
Kaufmans
Lautersteins, Inc.
H. D. Lee Mercantile Company
E. V. Price & Company
Southern Tailoring Company

VALVES

Hoffman Specialty Company

WEATHER INDICATORS

Wind Cones

Air Associates, Inc.
Air Ways Equip. Corp.
American Airport Equip. Co.
American Gas Accumulator
Crouse-Hinds Company
Karl Ort

Wind Socks

American Airport Equip. Co.
C. J. Hoigard Manufacturing Co.
Johnson Airplane & Supply Co.
OCS Manufacturing Co.

Wind Tees

Aircraft Industries, Inc.
Aircraft Service, Inc.
American Gas Accumulator
Grand Island Culvert & Met. Wks.
Karl Ort
Pyle-National Company
Qualls Electric Company

WEATHER INSTRUMENTS

American Paulin System
Brown & Sharpe Mfg. Co.
J. P. Friez & Sons
Henry J. Green
Pearless Laboratories
Taylor Instrument Co.
Westinghouse Electric & Mfg. Co.
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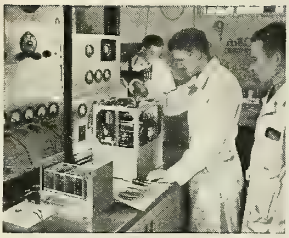

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DIRECTORY OF THE MANUFACTURERS OF AIRPORT & AIRLINE EQUIPMENT

A

Acme Fence & Iron Company
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W. F. Hammer, manager.
Equipment:
Fencing.

Air Associates, Inc.
Roosevelt Field, L. I., N. Y.
F. Leroy Hill, pres. & gen. mgr.; H. I. Crow, secy., treas. & gen, sales mgr. Branch managers: Ray Acre (Chicago), Ted Lynn (Glendale).
Branch offices:
5300 W. 63 St., Chicago; 1200 Airway, Glendale.
Equipment:
Wind cones, Wind direction indicators. Beacon lights. Hydraulic control equipment. Propeller service equipment. (A and Ja.)

Air Craft Service, Inc.
Cleveland Airport, Cleveland, O.
Equipment:
Wind tees (*Pilot Tee*).

Air-Ways Equipment Corp.,
Milwaukee, Wisconsin
Equipment:
Lighting equipment (boundary lights; interior illuminates). Weather indicators (Radi-cone wind direction and velocity indicators). Highway signs.

Airtemp Incorporated, Dayton. O.
B. T. Moyer, pres.; I. C. Baker, vice-pres. & operations mgr.; A. C. Staley, chief engineer.
Equipment:
Air controlling equipment.

Alamo Iron Works
San Antonio, Tex.
Equipment:
Fencing.

Allis-Chalmers Manufacturing Co.
1126 S. 70th St., Milwaukee, Wis.
H. C. Merritt, mgr., tractor division; W. A. Roberts, gen. sales mgr., tractor div.; G. M. Malmo, industrial sales mgr., tractor div. Branch managers: J. A. Conlan (Amarillo); M. R. Winder (Atlanta); C. A. Klopfer (Billings): C. C. Gross (Columbus); A. J. Simpson (Dallas); H. F. Merritt (Des Moines); G. W. McDonald (Fargo); C. E. Englar (Harrisburg); O. J. Thomas (Kansas City); E. D. Lanigan (LaPorte); C. E. Reinel (Madison); C. W. Hoffman (Memphis); W. J. Klein (Minneapolis); N. B. Nelson (Oakland); G. D. Meredith (Omaha); Ola. J. Thomas (Peoria); F. A. Perkins (Pocatello); A. E. Mills (Portland); G. N. Ellefson (Syracuse); E. L. Kirkpatrick (Wichita).
Branch offices:
99 North Polk St., Amarillo, Texas; 712 Ponce de Leon Place, Atlanta; 25th & Fourth Aves., Billings, Mont.; 784 Chambers Rd., Columbus, O.; 800 Young St., Dallas; East 3rd & Vine Sts., Des Moines, Ia.; 302 N. Pacific Ave., Fargo, N. D.; 40 S. Cameron St., Harrisburg, Pa.; 1224 W. 12th St., Sta. A, Kansas City, Mo.; 1001 Lincolnway, LaPorte, Ind.; 601 Williamson St., Madison, Wisc.; 387 S. Main St., Memphis; 700 Third St., S., Minneapolis; 2533 Peralta St., Oakland; 9th & Farnam Sts., Omaha; 1001 S. Washington St., Peoria; 602 First Ave., Pocatello, Idaho; 1305 Southeast Union Ave., Portland, Ore.; 943 W. Genesee St., Syracuse; 239 N. Rock Island, Wichita.
Equipment:
Tractors.

Allith-Prouty Mfg. Co.,
Danville, Illinois
D. E. Willard, pres.; H. A. Durr, vice-pres.; A. Macdonald, secy. and treas.; R. B. Older, chief eng.; N. B. Hart, sales and adv. mgr.
Equipment:
Hangar and fire door hardware (tracks, hangers for sliding or folding doors, bottom rollers for hangar doors).

All-Steel-Equip Co., Inc.,
Aurora, Illinois
John Knell, pres.; F. R. McQuown, vice-pres. and gen. sales mgr.; Norman L. Pearson, sales mgr. industrial division; J. M. Rolfe, sales promotion mgr.
Equipment:
Steel lockers, shop equipment (cabinets; tool boxes; tool stands).

American Blower Corp.,
Detroit, Mich.
Branch offices:
101 Marietta St. Bldg., Atlanta; Court Square Bldg., Baltimore; 1308 Webb Crawford Bldg., Birmingham; 1003 Statler Bldg., Boston; White Bldg., Buffalo; 910 S. Arizona St., Butte, Mont.; 1211 Commercial Bank Bldg., Charlotte, N. C.; 228 N. LaSalle St., Chicago; 1005-6 American Bldg., Cincinnati; 1302-3 Swetland Bldg., Cleveland; 503 S. Front St., Columbus; 619 Mercantile Bldg., Dallas; 810 14th St., Denver; 1003 Hubbell Bldg., Des Moines; 632 Fisher Bldg., Detroit; 401 N. Santa Fe St., P. O. Box 512, El Paso; 200 Division Ave., N., Grand Rapids; 201 Petroleum Bldg., Houston; 625 Architects & Bldrs. Bldg., Indianapolis; 310 Mutual Bldg., Kansas City, Mo.; 429 Shell Bldg., 1008 W. 6th St., Los Angeles; 620 S. 5th St., Louisville; 422-3 Exchange Bldg., Memphis; P. O. Box 2017—219 Miami Bldrs. Exchange, Miami; 1011 Majestic Bldg., Milwaukee; 307 Essex Bldg., Minneapolis; 247-9 High St, Newark; 326 Chamber of Commerce Bldg., New Haven, Conn.; 846 Baronne St., New Orleans; 40 W. 40th St., New York; 1425 W. O. W. Bldg., Omaha; 781 Broad St. Station Bldg., 16th St. & Penn Blvd., Philadelphia; 1433 Oliver Bldg., Pittsburgh; 311 Pacific Bldg., Portland, Ore.; 7 N. 6th St., Richmond; Builders Exchange Bldg., 135 Spring St., Rochester, N. Y.; Railway Exchange Bldg., St. Louis; Dooly Bldg., Salt Lake City; 436 Main Ave., San Antonio; 1414 Bank of America Bldg., 625 Market St., San Francisco; Imperial Bldg., 331 State St., Schenectady; 1534 First Ave., S., Seattle; 1127 St. Paul Ave., Tacoma; 655 State St., Toledo; Woodward Bldg., 15th & H Sts., N. W., Washington; Avenida Juarez No. 24, Mexico City, Mexico, D. F. Export division: 40 W. 40th St., New York.
Equipment:
Hangar heaters (*Sirocco* and *Venturafin*).

American Chain Company, Inc.,
Bridgeport, Connecticut
Sales managers: O. R. McDonald, Manley Manufacturing Division (York, Pa.); W. H. Bleecker, Page Steel & Wire Division, (Monessen, Pa.); R. C. Blair, Wright Manufacturing Division (York).
Factories:
Bridgeport, Conn.; York, Braddock and Monessen, Pa.
Branch offices:
New York; Boston; Chicago; York, Pa.; San Francisco, Calif.; Pittsburgh, Pa.; Detroit, Mich.
Equipment:
Shop equipment (*Manley* jacks; trestles; engine stands; hoists). Fencing (*Page*).

American Engineering Company,
Philadelphia, Pennsylvania
W. V. Sauter, pres.; W. C. Williamson, vice-pres.; C. L. Cushmore, secy. and treas.; J. G. Worker, gen. sales mgr.
Equipment:
Air compressors.

American Airport Equipment Co.,
Chicago, Illinois
Equipment:
Lighting equipment (wind cones; boundary and approach cone markers; obstruction, boundary approach marker lights). Interchangeable wind socks.

American Gas Accumulator Co.,
Elizabeth, New Jersey
L. M. Merrill, chairman management committee; V. L. Oestnaes, chief engineer; I. J. Mack, mgr., electrical division; L. C. Simpson, mgr., airport lighting division (Washington); F. A. Gurdes (Chicago); R. L. Atwell (Richmond); C. A. Ward (Peoria).
Branch offices:
Washington; New York; Pittsburgh; Chicago; Peoria; Richmond. Representatives: Collins-Powell Co., Los Angeles; Filer Equipment Co., Miami; Handlan Inc., St. Louis; Hixon Electric Co., Boston; R. A. Kelly, Columbus; Mountain States Machinery Co., Denver; Turner Supply Co., Mobile, Ala.; Sperry Gyroscope Co., San Francisco, and Seattle; Line Material Co., South Milwaukee, Wisc., and East Stroudsburg, Pa.
Equipment:
Lighting (*AGA* beacons; wind tees; wind cones; marker; boundary; range; obstruction; landing area floodlights; ceiling projectors; ceiling height indicators; hangar apron floodlighting; roof markers).

American Heating & Ventilating Co., Philadelphia, Pennsylvania
Equipment:
Hangar heaters.

American-La France & Foamite Industries, Inc., Elmira, New York
E. E. O'Neill, gen. sales mgr.; W. R. Rollo, Mgr., aviation dept.
Branch offices:
181 Spring St., N. W., Atlanta; 28 Brighton Ave., Boston; 445 N. Lake Shore Drive, Chicago; 1415 W. 9th St., Cleveland; 1741-43 Arapahoe St., Denver; 4823 Woodward Ave., Detroit; 100 E. La France St., Elmira, N. Y.; 818 M & M Bldg., Houston; 1621 McGee St., Kansas City, Mo.; 749 Kohler St., Los Angeles; 250 W. 57th St., New York; 401 N. Broad St., Philadelphia; 318 Penn Ave., Pittsburgh; 78 Jackson St., Seattle; Cor. Division and Trent Sts., Spokane.
Equipment:
Fire extinguishers (foamite *Crusader; Alfite*). [A].

American Oil Co.,
Baltimore, Maryland
Jacob Blaustein, pres.; Alvin Thalheimer, vice-pres.; D. H. Baker, secy.; J. H. Carroll, Jr., treas.; J. W. Carney, gen. sales mgr.; F. A. Colonell, sales mgr.
Products:
Petroleum (*Amoco* gasoline; oil).

American Paulin System,
S. Flower St., Los Angeles, Calif.
Equipment:
Weather instruments (barometers).

American Radiator Co.,
New York, N. Y.
Arthur R. Herske, vice-pres. and gen. mgr. of sales; Marshall Adams, sales production mgr.; Max D. Rose, vice-pres. and eastern sales mgr.; D. E. Kennedy, vice-pres. and western sales mgr.; William E. Kugeman, vice-pres. and export mgr.
Equipment:
Hangar heaters.

The American Rolling Mill Co.,
Middletown, Ohio
G. F. Ahlbrandt, gen. sales mgr.; H. M. Richards, asst. gen. sales mgr.; E. A. Emerson, export mgr.
Equipment:
Hangar doors.

American Steel & Wire Company,
208 S. LaSalle St., Chicago, Ill.
(Cleveland office) C. F. Blackmer, pres.; C. F. Hood, vice-pres.; A. F. Allen, sec.-treas.; F. E. Chesney, purchasing agent. (Chicago office) D. A. Merriman, vice-pres. and gen. mgr. of sales; W. H. Cordes, advertising mgr.; C. F. Wiley, mgr. (Worcester, Mass.) John May, asst. gen. mgr. of sales. Managers: A. H. Mowry, (New York); G. H. Mackelcan (Baltimore); H. D. Sharp (Boston).
Branch offices:
101 Marietta St., Atlanta; First National Bank Bldg., Baltimore; Brown-Marx Bldg., Birmingham; Statler Bldg., Boston; Liberty Bank Bldg., Buffalo; Union Trust Bldg., Cincinnati; Rockefeller Bldg., Cleveland; Praetorian Bldg., Dallas; First National Bank Bldg., Denver; General Motors Bldg., Detroit; Petroleum Bldg., Houston; 417 Grand Ave., Kansas City, Mo.; Sterick Bldg., Memphis; Bankers Bldg., Milwaukee; First National Bank Bldg., St. Paul; Empire State Bldg., New York; Ramsey Tower, Oklahoma City; Broad St. Station Bldg., Philadelphia; Frick Bldg., Pittsburgh; Walker Bank Bldg., Salt Lake City; 506 Olive St., St. Louis; Miners Bank Bldg., Wilkes-Barre; 94 Grove St., Worcester, Mass. Columbia Steel Co. (Pacific Coast Distributors) Russ Bldg., San Francisco; 2087 E. Slauson Ave., Los Angeles; 2345 N. W. Nicolai St., Portland, Ore.; 1054-4 Ave., S., Seattle.
Equipment:
Lighting equipment. (Ju).

Anaconda Wire and Cable Co.
25 Broadway, New York, N. Y.
E. F. Luna, sales promotion dept.
Factories:
Hastings-on-Hudson, New York.
Branch offices:
20 North Wacker Drive, Chicago.
Equipment:
Lighting equipment (Cable [*Duraseal* for buried power and lighting circuits; rubber-jacketed *Securityflex;* radio; ground; starter]; wire [building braided, leaded or armored; antenna; radio; neon sign; ignition; ground; lightning, plain or armored]; lightning rods).

Anchor Post Fence Co.,
Baltimore, Maryland
Factories:
Baltimore; Cleveland; San Francisco.
Branch offices:
Home Savings Bank Bldg., Albany; 238 Main St., Cambridge, Mass.; Jackson Bldg., Buffalo; 333 N. Michigan Ave., Chicago; Builder's Exchange Bldg., Cleveland; Architects' Bldg., Detroit; 43 Farmington Ave., Hartford, Conn.; 167 Jericho Turnpike, Mineola, L. I., N. Y.; 9 E. 38th St., New York; 194 Frelinghuysen Ave., Newark; Broad St. & Allegheny Ave., Philadelphia; 460 Fifth St., San Francisc; 18 N. Lexington Ave., White Plains, N. Y.
Equipment:
Fencing.

S. Appel & Co., New York, N. Y.
Branch office:
Miami, Florida.
Equipment:
Uniforms.

Aqua Systems, Inc.,
New York, N. Y.
Charles F. Beckwith, pres.; A. C. Kaestner, secy.-treas.
Equipment:
Fueling systems.

Armco Culvert Mfrs. Association,
Middletown, Ohio
Equipment:
Drainage piping (*Armco* corrugated metal for sewers and stream enclosures; paved invert; perforated for subdrain-

(*Continued on following page*)

10 *Years of Leadership*

SINCE 1926—the first year of Government registration of aircraft—Waco has had more airplanes in service than any other manufacturer. During the first eight months of 1936, 33 per cent more new Wacos were licensed than during the corresponding period last year! The consistently outstanding performance and dependability that have brought this widespread acceptance to Waco, insure complete owner-satisfaction and high resale value.

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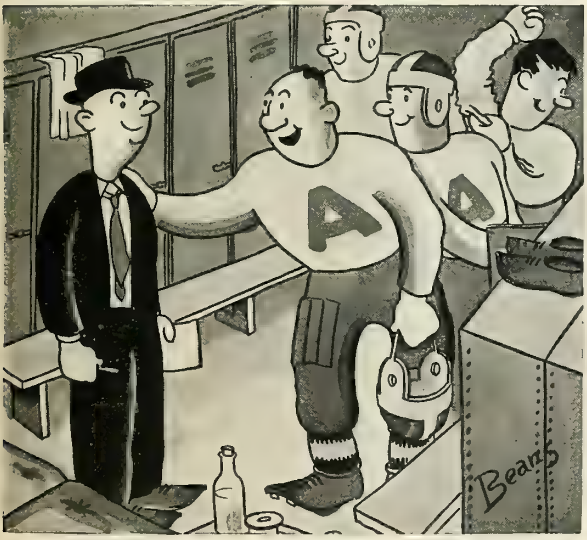

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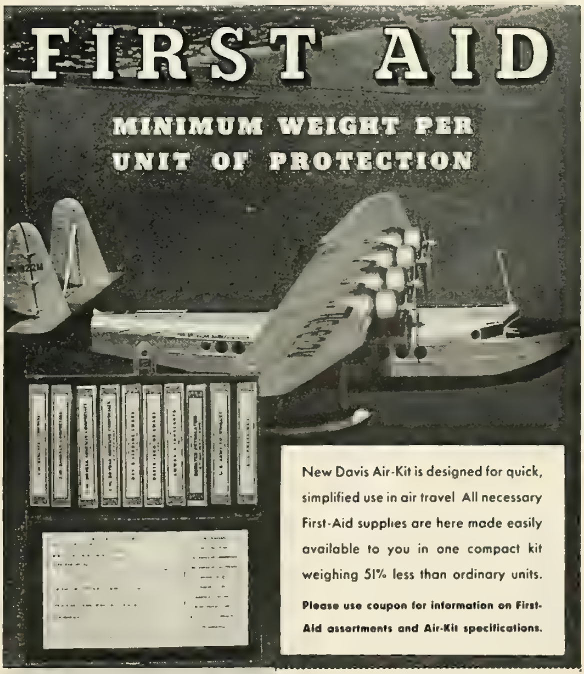

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age; multi plate pipe and arches for large drains and underpasses; part circle culverts; *Spiral* welded for water supply lines). Automatic drainage gates. Metal crib retaining walls.

Associated Oil Company,
San Francisco, California
William F. Humphrey, pres.; L. F. Bayer, vice-pres. in charge of mfg.; B. I. Graves, vice-pres. in charge sales; L. D. Jurs, vice-pres. in charge eng.; J. P. Edwards, secy.; W. A. Sloan, treas.; P. E. Allan, domestic sales mgr.; R. S. Turner, export mgr.
Products:
Petroleum; gasoline; *Cycol Aero* and *Veedol Aero* oils).

Atlas Press Co.,
Kalamazoo, Michigan
Equipment:
Shop equipment (presses [drill, hydraulic, arbor]; metal and wood lathes; grinders; motors; shop tools; accessories).

Auto Compressor Co.,
Wilmington, Ohio
Equipment:
Air compressors.

Autovent Fan & Blower Company,
1805 N. Kostner, Chicago, Illinois
T. Brown, gen. mgr.
Equipment:
Propeller fans. Centrifugal blowers. Steam unit heaters.

The Austin Company,
Cleveland, Ohio
W. J. Austin, pres. and gen. mgr.; G. A. Bryant, Jr.; exec. vice-pres.; Albert S. Low, vice-pres. and chief eng.; C. W. Kinnison, secy.-treas.
Branch offices:
19 Rector St., New York; 510 N. Dearborn St., Chicago; Commercial Trust Bldg., Philadelphia; 2842 W. Grand Blvd., Detroit; Union Trust Bldg., Pittsburgh; Dexter Horton Bldg., Seattle; Porter Bldg., Portland, Ore.; 516 18th St., Oakland; The Austin Company of California, 777 E. Washington St., Los Angeles.
Equipment:
Structures. (Also airport consultants, engineers, builders).

Autonator Laboratories, Inc.,
8449 S. Chicago St., Chicago, Ill.
Equipment:
Electrical generators. (A).

B

Badger Fire Extinguisher Co.,
Park Square Bldg., Boston, Mass.
Branch offices:
123 William St., New York.
Equipment:
Fire extinguishers (soda-acid; foam). (A).

Baker Raulang Co.—Baker Industrial Truck Div., Cleveland, Ohio
E. J. Bartlett, pres.; A. J. Gates, vice-pres. & gen. sales mgr.; J. W. Morgan, sec.-treas.; E. H. Remde, gen. mgr.; E. W. Sankey, purchasing agent.
Equipment:
Tractors.

Barber Asphalt Company,
1600 Arch St., Philadelphia, Pa.
Branch offices:
New York; Chicago; St. Louis.
Products:
Runway surfacing materials.

The Barrett Co., New York, N. Y.
E. W. Clark, pres.; Alfred L. Loebenberg, vice-pres.; R. L. Cammann, director of sales; E. R. Snyder, gen. mgr.
Products:
Surfacing materials.

Bartow Beacons, Inc.,
1605 Walnut St., Philadelphia, Pa.
J. B. Bartow, pres. and mgr.; S. Lewis Ziegler, Jr., vice-pres. and engineer; C. T. Ludington, sec. and treas.
Branch office:
Blue Bell, Pa.
Equipment:
Lighting equipment (beacons; visual landing system).

Bauer & Black, Chicago, Ill.
R. A. Whidden, pres.; C. K. Perkins, vice-pres. and gen. sales mgr.; H. B. Crow, sales mgr.; J. R. Strohecker, asst. gen. sales mgr.
Equipment:
First aid kits. (A).

Bausch & Lomb Optical Co.,
Rochester, New York
Managers: L. I. Withington, (Chicago); Haller Belt (San Francisco); T. J. Byrne, 62 W. 47th St.; E. H. Anthes, RCA Bldg., (New York).
Branch offices:
Kesner Bldg., Chicago; 593 Market St., San Francisco; 62 W. 47th St., and RCA Bldg., New York; 131 Clarendon St., Boston; 542 S. Broadway, Los Angeles; 1700 Walnut St., Philadelphia; 1324 Eye St., N. W., Washington.
Equipment:
Lighting equipment (reflectors [signal; course light; beacon; searchlight]; mirrors, parabolic for field lighting and searchlights; searchlight fronts). (A).

B-B-T Corp. of America,
Elizabeth, N. J.
Equipment:
Lighting equipment.

John Bean Manufacturing Company,
217 W. Julian, San Jose, Calif.
J. D. Crummey, pres.; Paul Davies, vice-pres. and treas.; Ogden S. Sells, gen. sales mgr.; F. A. Hanson, adv. and sales mgr.; F. L. Burrell, gen. mgr.
Equipment:
Battery chargers.

Bennett Air Service,
Hightstown, N. J.
A. B. Bennett, pres.
Equipment:
Portable hangars.

Bennett Pump Corp.,
Muskegon, Mich.
Equipment:
Oil pumps.

Benson Ornmntl. Bronze & Lghtng. Co.
Kansas City, Missouri
E. B. Benson.
Equipment:
De-icing equipment.

The Berger Manufacturing Co.,
(Division of Republic Steel Corp.),
Canton, Ohio
R. J. Wysor, pres.; L. S. Hamaker, vice-pres. and gen. mgr.; W. C. Gubbins, sec.-treas.; J. W. Strong, gen. sales mgr.; L. W. Shorter, export mgr.
Equipment:
Lockers (steel *Berloy*).

Berry Asphalt Company,
Chicago, Illinois
B. H. Roberts, pres.; H. B. Pullar, vice-pres. & gen. mgr.; S. H. Giesy, asst. sales mgr.; A. W. Smith, asst. gen. mgr.; A. T. Van Pelt, refinery supt.; A. H. Anderson, sec. and treas.
Refinery:
Waterloo, Arkansas.
Products:
Runway surfacing material (*Berry Emulsified Asphalt* [hot mix]; *Berry Cold Lay* asphalt).

Binks Mfg. Co., Chicago, Il.
Neil C. Hurley, pres.; J. F. Roche, exec. vice-pres. and gen. mgr.; J. C. Johnson, sec.; Wm. B. Crawford, sales mgr.; A. E. Wendt, purchasing agent; Wm. Hoch, treas.
Equipment:
Shop equipment (paint spray units).

Black & Decker Manufacturing Co.,
Towson, Maryland
S. Duncan Black, pres., Alonzo G. Decker, vice-pres. and gen. mgr.; Frank J. Nagell, treas.; Charles A. Sacra, sec.
Branch offices:
Boston; New York; Philadelphia; Baltimore; Atlanta; Cleveland; Chicago; Kansas City, Mo.; Detroit; Oakland; Buffalo; Minneapolis; Dallas; St. Louis; Montreal; Toronto.
Equipment:
Shop equipment (portable electric tools [electric hand drills; valve refacers; hole saws; *Torsimeter* screw drivers; nut runners; grinders; sanders; planers; polishers; bench grinders; valve seat grinders and cutters]; drill stands; electric drill accessories; socket wrenches; wire wheel brushes; Heat guns; Portable *Loadometers* for weighing planes). (Ja).

Blackmer Pump Company,
Grand Rapids, Michigan
A. B. Klise, chairman; R. G. Klise, asst. to chairman; A. L. Rock, export mgr.; B. P. Hetler, adv. and gen. sales mgr.
Equipment:
Pumps (rotary).

Blaw-Knox Co., Pittsburgh, Pa.
D. Clinton Grove, advt. mgr.
Branch offices:
New York; Chicago; Birmingham; Philadelphia.
Equipment:
Hangars.

The Bon Ami Co., New York, N. Y.
Eversley Childs, pres.; A. E. Davison, vice-pres. & gen. mgr.; L. G. Clark, sec.-treas.; J. A. Nelson, sales mgr.
Products:
Cleansing material.

Bonney Forge & Tool Works,
Allentown, Pennsylvania
A. J. Male, mgr., aviation sales.
Equipment:
Shop equipment (tools; wrenches). (Ja)

S. F. Bowser & Co., Ft. Wayne, Ind.
E. C. Marsh, gen. sales mgr.; H. E. Dobson, export representative, and J. A. Forsythe, mgr. (New York). Managers: I. D. Bone (Albany); H. W. Luhmann (Boston); J. A. Merrill (Chicago); H. W. Stahl (Cleveland); E. H. Straube (Minneapolis); C. R. Huston (St. Louis); C. A. Weego (Dallas); D. C. Price (Detroit); R. R. Dooley (Philadelphia); W. F. MacAuley (San Francisco).
Branch offices:
1011 Broadway, Albany; Park Square Bldg., Boston; 2011 S. Michigan Ave., Chicago; 1714 Chester Ave., Cleveland; 3615 Olive St., St. Louis; 1615 Bryan St., Dallas; 2051 W. Lafayette Blvd., Detroit; 155 E. 44th St., New York; 617 Washington Ave., N., Minneapolis; Insurance Co. of N. American Bldg., Philadelphia; 502 Oliver Bldg., Pittsburgh; 468 Ninth St., San Francisco.
Equipment:
Fueling systems. Recording devices (*Xacto*). Rotary pumps. Pipe line strainers. Air release units. Floodlights. Flat suction units. Centrifugal filters. Hose nozzles.

Breting Radio Co.,
Los Angeles, Calif.
Equipment:
Radio.

Briggs & Stratton Corporation,
2711 N. 13th, Milwaukee, Wisc.
S. F. Briggs, pres.; C. L. Coughlin, vice-pres.; E. Bodendoerfer, secy.; E. V. Oehler, adv. and gen. sales mgr.
Equipment:
Portable starters.

Ralph N. Brodie Company, Inc.,
61st & Lowell Sts., Oakland, Calif.
Branch offices:
425 Chrysler Bldg., New York; 59 Van Buren St., Chicago; 1001 E. 8th St., Los Angeles; 315 Occidental Ave., Seattle.
Equipment:
Gasoline and oil meters. Pipe line strainers. Air eliminators.

Brown & Sharpe Mfg. Co.,
235 Promenade, Providence, R. I.
H. D. Sharpe, pres. & treas.; vice-presidents: W. A. Viall and P. C. DeWolf; H. Buker, vice-pres. & gen. sales mgr.
Equipment:
Protractors.

The Brunner Manufacturing Co.,
1821 Broad, Utica, New York
L. J. Brunner, chairman of the board; G. L. Brunner, pres.; B. J. Scholl, sec.; A. G. Zumbrun, treas.; H. E. Thompson, chief engineer.
Equipment:
Air compressors.

Bryant Heater Company,
Cleveland, Ohio
H. N. Mallon, pres.; L. C. Harvey, vice-pres. and sales mgr.; R. E. Reimer, treas.
Equipment:
Hangar heaters.

Buffalo Fire Appliance Co.,
Buffalo, New York
Equipment:
Fire extinguishers. (A)

Buffalo-Springfield Roller Co.,
Springfield, Ohio
Branch offices:
Brisbane Bldg., Buffalo; 3703 Powelton Ave., Philadelphia; 11 Carleton St., Cambridge, Mass.; 150 Nassau St., New York.
Equipment:
Maintenance apparatus (rollers).

E. D. Bullard Company,
275-8th St., San Francisco, Calif.
Branch offices:
1229 S. Olive St., Los Angeles; 1620 Yalecrest Ave., Salt Lake City, Utah; 215 S. Leavitt St., Chicago; 1 Main St., Houston, Tex.
Equipment:
Sirens.

Buffalo Forge Co., Buffalo, N. Y.
Equipment:
Heaters (unit gas; steam).

Bull Dog Electric Products Co.,
Detroit, Michigan
Equipment:
Lighting equipment.

Burroughs Wellcome & Co., Inc.,
9-11 E. 41st St., New York, N. Y.
Laboratories and works:
Tuckahoe, N. Y.
Equipment:
Tabloid first-aid kits and first-aid supplies. (A)

Burton-Rogers Co., Boston, Mass.
C. W. Burton, pres.
Equipment:
Shop equipment (electrical test meters).

Butler Manufacturing Company,
Kansas City, Missouri
E. E. Norquist, pres.; C. C. Crouch, vice-pres. and director of sales; Oscar D. Nelson, treas & gen. mgr.
Equipment:
Hangars. Fuel pumps.

C

Caldwell & Assn., Kansas City, Mo
Equipment:
Air conditioning equipment.

Carnegie-Illinois Steel Corp.,
Frick Bldg., Pittsburgh, Pa.
B. F. Fairless, pres.,; C. V. McKaig, vice-pres. and gen. mgr. of sales.
Branch office:
Chicago.
Equipment:
Hangar doors. Culverts. Roofing and siding. (Ju).

John Catillon & Sons,
New York, N. Y.
Equipment:
Scales.

Carrier Engineering Corporation,
Newark, New Jersey
Willis H. Carrier, chairman of the board; J. I. Lyle, pres.; L. R. Boulware, vice-pres. & gen. mgr.; vice-presidents: H. Paul Gant; Wm. H. Price, Jr.; E. T. Murphy; Donald French; P. V. Osborn; E. P. Heckel; C. J. Staples, sec.; M. E. Snyder, treas.
Equipment:
Air conditioning apparatus.

Caterpillar Tractor Co., Peoria, Ill.
E. R. Galvin, asst. gen. sales mgr.; Henry M. Hale, eastern sales mgr.; H. H. Chambers, western sales mgr.; Paul Weeks, mgr. of special sales division.
Factories:
Peoria; San Leandro, Calif.
Warehouses:
Learned St., Albany, N. Y.; Kansas City, Kans.; Memphis; Minneapolis; Moose Jaw, Saskatchewan, Canada; Spokane, Wash.
Branch offices:
50 Church St., New York; Munsey Bldg., Washington.
Equipment:
Tractors. Maintenance machinery (Diesel and gasoline *Auto Patrol; Hi-Way Patrol; Trailer Patrol;* elevating graders; blade graders; power units).

The Cement Institute,
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Products:
Surfacing material.

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Delta Manufacturing Co.,
3775 N. Holton, Milwaukee, Wisc.
H. E. Tautz, pres. & treas.; R. C. Beck, vice-pres.; M. Doyle sec.; R. Melius, gen. sales mgr.
Equipment:
Shop equipment (drill presses, portable woodworking machinery).

Denver Sewer Pipe & Clay Co.,
Denver, Colorado
Equipment:
Drainage pipes.

Detroit Harvester Co.,
Detroit, Michigan
C. R. Long, sales dept.
Equipment:
Maintenance apparatus (mowers; snow removers).

Detroit Steel Products Company,
2252 E. Grand Blvd., Detroit, Mich.
Equipment:
Hangar doors.

The DeVilbiss Company,
Toledo, Ohio
A. D. Gutchess, pres.; F. A. Bailey, vice-pres. & gen. mgr.; W. F. Gradolph, vice-pres. in charge of sales; R. A. Guyer, sales mgr. spray equipment and compressor division.
Equipment:
Air compressors. (Ja) Shop equipment: paint sprayers.

C. A. Dunham Company,
Chicago, Illinois
C. A. Dunham, pres. & treas.; F. E. Schmidt, vice-pres.; C. M. Brigham, gen. sales mgr.
Equipment:
Hangar heaters.

Durabilt Steel Locker Company,
453 Arnold Ave., Aurora, Ill.
Equipment:
Overhead metal and wood doors for hangars. Lockers.

Duro Metal Products Co.,
Chicago, Illinois
W. R. Hosford, sales mgr., automotive division.
Equipment:
Shop equipment (wrenches [open end; box; socket type]; screw drivers; electric drills).

E

Eclipse Aviation Corporation,
East Orange, New Jersey
Charles Marcus, pres.; R. P. Lansing, vice-pres.; H. A. Gossner, sec.; W. J. Buettner, treas.; C. H. Knoch, asst. sec.-treas.; A. E. Raabe, sales mgr. & asst. sec.
Factories:
(Aircraft Accessories) East Orange, N. J.; (Foundry Division) Little Falls, N. J.
Equipment:
Engine starters (external energizer). De-icing equipment.
[A, Ju and Ja].

Esline Co., Oconomowac, Wis.
Equipment:
Hangars. Hangar doors.

Ethyl Gasoline Corp.,
New York, N. Y.
E. W. Webb, pres.; J. C. Gonzalez, sec.; J. C. Mehring, treas.; J. C. Taylor, gen. sales mgr.
Products:
Petroleum (*Ethyl* gasoline).

Eversman Manufacturing Co., Inc.,
453 Broadway, Denver, Colorado
Equipment:
Maintenance apparatus (automatic land leveling machines).

F

Fairbanks, Morse & Company,
900 S. Wabash Ave., Chicago, Ill.
Col. R. H. Morse, pres. & gen. mgr.; P. C. Brooks, vice-pres.; S. T. Kiddoo, vice-pres. & treas.; A. C. Dodge, vice-pres. & gen. sales mgr.
Equipment:
Pumps, motors scales, Diesel and gasoline engines. Water system. Generators

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Equipment:
Heating and ventilating equipment.

Federal Electric Co., Inc.,
8700 S. State, Chicago, Illinois
Chas. Borland, pres.; W. D. Krupke, vice-pres. in charge of sales.
Equipment:
Sirens.

Fisk Brothers Refining Co.
24 State St., New York, New York
F. J. Snyder, pres.; Wm. M. Teetsel, vice-pres.; C. Rodriguez, vice-pres.; F. W. Edwards, sec.-treas.; Robert L. Watts, gen. mgr., Lubriplate Division.
Factories:
Newark; Toledo.
Products:
Lubricants (*Lubriplate*).

Flexrock Co., Philadelphia, Pa.
C. G. Milner, gen. mgr.; Fred M. Betz, sec. and treas.; Chas. E. Hess, technical engineer.
Branch offices:
343 W. 43rd St., New York; 564 Market St., San Francisco; 455 P. Brown Bldg., St. Louis; 1965 Porter St., Detroit; 219 E. N. Water St., Chicago; Guardian Bldg., Cleveland; 917 New Industrial Trust Bldg., Providence; 17 Federal St., Pittsburgh.
Equipment:
Maintenance equipment (*Ruggedwear* resurfacer).

Forest Electric Co., Newark, N. J.
Equipment:
Battery chargers.

Julien P. Friez & Sons, Inc.,
Belfort Observatory, Baltimore, Md.
Lucien L. Friez, pres. & gen. mgr.; Russell B. Stevenson, sales mgr.
Branch offices:
Air Conditioning Utilities, Inc., 8 W. 40 St., New York; Pacific Scientific Co., 120 Maple Ave., Los Angeles and 37 Spear St., San Francisco.
Equipment:
Wind indicating and recording equipment (complete weather assemblages; recording altimeters; multiconditions recorders of upper air flight conditions).

Frigidaire Corp., Dayton, Ohio
E. G. Biechler, pres. & gen. mgr.; W. F. Armstrong, asst. gen. mgr.; C. A. Copp, gen. sales mgr.
Equipment:
Air conditioning equipment.

Fyr Fyter Co., Dayton, Ohio
Equipment:
Fire extinguishers. (A)

G

Gardner-Denver Co., Quincy, Ill.
R. J. MacFarland, F. T. Wells, B. P. Spann.
Branch offices:
Albany and New York, N. Y.; Atlanta; Birmingham; Boston; Butte, Mont.; Charleston, W. Va.; Chicago; Columbus, O.; Dallas, El Paso, Houston and Kilgore, Tex.; Denver; Detroit; Duluth, St. Paul and Minneapolis, Minn.; Kansas City and St. Louis, Mo.; Knoxville; Los Angeles; San Francisco; Philadelphia, Pittsburgh, Pottsville and Scranton, Pa.; Portland, Ore.; Salt Lake City; Tulsa; Wallace, Idaho; Washington.
Equipment:
Air compressors.

Garrision Engineering Corporation,
Great Barrington, Massachusetts
Branch offices:
New York, Chicago, Boston.
Equipment:
Fire extinguishers (wheeled engines; motor driven fire apparatus; *Garfire* gun; dry compound).

Garland Products Company, Inc.,
St. Louis, Missouri
Products:
Petroleum (*Luber-Tone* gasoline; oil).

Gelhaar Uniform Co.,
Kansas City, Mo.
Equipment:
Uniforms.

General Cable Corporation,
New York, New York
Factories:
Buffalo, N. Y.; Bayonne, N. J.; Emeryville, Calif.; Pawtucket, R. I.; Perth Amboy, N. J.; Rome, N. Y.; St. Louis, Mo.; Los Angeles, Calif.
Branch offices:
Healey Bldg, Atlanta; 89 Broad St., Boston; 56 Clyde Ave., Buffalo; 20 N. Wacker Drive, Chicago; 2637 Superior Ave., Cleveland; Interurban Bldg., Dallas; New Center Bldg., Detroit, 3600 E. Olympic Blvd., Los Angeles; 123 S. Broad St., Philadelphia; Koppers Bldg., Pittsburgh; Ambassador Bldg., St. Louis; 1000 Mill St., Rome, N. Y.; 30 Otis St., San Francisco; Smith Tower, Seattle; 730-15th St., N.W., Washington.
Equipment:
Cable and cable accessories (*Parkway; Trenchlay;* junction boxes; terminals, splicing material). Portable cord (jacketed *Thickol* and *Duprene*). Building wire. Welding cable. Combination landing light cable. Ignition cable. Lighting cable. Moulded ignition manifold. Magnet wire. Radio antenna wire. Starter and battery cable. (A and Ju)

General Electric Company,
Schenectady, New York
J. C. Miller, mgr. of sales, aeronautical section, industrial dept.; H. C. Ritchie, airport and airway lighting; E. G. Haven, application engineering; E. O. Shreve, vice-pres. in charge of sales; J. E. N. Hume, mgr.
Equipment:
Lighting equipment (flood; beacon; boundary; runway). Electric motors, generators, and related control equipment. Accessry power plants. Cable and cable accessories. Battery chargers. Welding equipment and accessories. (A, Ju and Ja)

General Fireproofing Company,
Youngstown, Ohio
Equipment:
Lockers.

The General Fire Truck Corp.,
St. Louis, Missouri
G. D. Kite, in charge of fire extinguisher division.
Equipment:
Fire extinguishers (soda-acid; foam; carbon-tetrachloride).

General Refrigeration Sales Co.,
Beloit, Wisconsin
F. R. Erbach, vice-pres. and chief eng.; D. G. Fifield, sales promotion mgr.
Equipment:
Air conditioners.

Gilbert & Barker Mfg. Co.,
Springfield, Massachusetts
Stanley C. Hope, pres.; P. H. Bills, vice-pres. and treas.; K. S. Edwards, sales mgr. pump and tank division.
Equipment:
Pumps (oil; fuel). Fuel systems.

Gilmore Oil Co., Los Angeles, Calif.
E. B. Gilmore, pres.; C. S. Beesemyer, exec. vice-pres.; S. M. Salisbury, vice-pres. and sec.; J. L. Coates, treas.; S. A. McNeil, B. A. Rowell and W. G. Julier, asst. sec.
Products:
Surfacing material (*Roadamite* road oils and asphalt; oil).

Globe Air Compressor Company,
New York, New York
Equipment:
Air compressors.

The B. F. Goodrich Company
Akron, Ohio
T. A. Aspell, gen. sales mgr.; J. S. Pedler, mgr. aeronautical sales dept.
Factories:
Akron; Los Angeles; Kitchener, Ontario, Canada.
Branch offices:
1043 Broadway, Albany; 376 Nelson St., S. W., Atlanta; 109 Brookline Ave., Boston; 1050 Main St., Buffalo; 4th & Brevard St., Charlotte, N. C.; 310 W. Taylor St., Chicago; Central Parkway at Sycamore St., Cincinnati; 4700 Prospect Ave., Cleveland; 4136 Commerce St., Dallas; 2625 Walnut St., Denver; 10430 Locust St., Des Moines; 2792 E. Grand Blvd., Detroit; 2009 Capitol Ave., Houston; 2422 Broadway, Kansas City, Mo.; 5400 E. Ninth, Los Angeles; 809 N. Jefferson, Milwaukee; 306 First Ave., N., Minneapolis; 133 Frelinghuysen Ave., Newark; 1742 St. Charles Ave., New Orleans; 619 W. 54th St., New York; 2034 Farnam St., Omaha; 1955 Hunting Park Ave., Philadelphia; 5740 Baum Blvd., Pittsburgh; 4481 Duncan Ave., St. Louis; 355 Brannan St., San Francisco; 1049 Railroad Ave., S., Seattle; 1522 14th St., N. W., Washington, D. C.

Goulds Pumps, Inc.
Seneca Falls, N. Y.
Branch offices:
Marietta St., Bldg., Atlanta; 210 South St., Boston; 53 W. Jackson Blvd., Chicago; Shell Bldg., Houston; 16 Murray St., New York; 111 N. 3rd St., Philadelphia; Henry W. Oliver Bldg., Pittsburgh; 213 E. Archer St., Tulsa.
Equipment:
Pumps (water; sewage; sump). Oil purifiers (*Hydroil*).

Grand Is. Culvert & Metal Works,
Grand Island, Nebraska
Equipment:
Wind tees.

Henry J. Green,
1191 Bedford Ave., Brooklyn, N. Y.
Equipment:
Meteorological instruments (barometers; barographs; anemometers; registers; wind vanes; psychrometers; thermometers, maximum, minimum, mercurial; hygrographs; hygro-thermographs).

Greenfield Tap and Die Corp.,
Greenfield, Massachusetts
Col. F. H. Payne, pres.; F. A. Smith, vice-pres. and gen. mgr.; W. B. duMont, vice-pres. in charge of sales.
Factory:
Greenfield; Detroit.
Branch offices:
2102 W. Fort St., Detroit; 15 Warren St., New York; 611 W. Washington Blvd., Chicago.
Equipment:
Shop equipment (taps; dies; drills; reamers; screw plates; screw extractors; pipe tools; gages). (Ja).

Geiger's Men's Shop, Inc.,
17136 Lorain Ave., Cleveland, O.
Equipment:
Uniforms.

Grinnel Co., Inc., Providence, R. I.
Russell Grinnell, pres.; W. A. Neracher, 1st vice-pres.; H. B. Cross, sec.; L. W. Jones, vice-pres. & treas.; N. P. Conway, vice-pres. and gen. sales mgr.; C. P. Riegger, gen. purchasing agent.
Equipment:
Grinnell sprinkler systems.

Grocer Printing Company,
Salt Lake City, Utah
Equipment:
Tickets.

Gulf Oil Corporation,
Gulf Building, Pittsburgh, Pa.
J. Frank Drake, pres.; W. V. Hartman, vice-pres.; W. R. Huber, adv. and sales promotion mgr. Aviation sales department: Major Alford Williams, mgr.; T. Harold "Doc" Kincaid, lubricating engineer.
Products:
Petroleum (gasoline; *Gulfpride* oil).

H

Hammarlund Mfg. Co.
New York, N. Y.
Oscar Hammarlund, pres.; Lloyd A. Hammarlund, sec. & gen. sales mgr.
Equipment:
Radio.

Hancock Tile Co., Findlay, Ohio
Equipment:
Drainage pipes.

Harvey Radio Laboratories,
12 Boylston St., Brookline, Mass.
J. B. Parker, gen. mgr.; C. A. Harvey, chief engineer.
Equipment:
Radio (transmitters).

Hauenstein & Burmeister, Inc.,
Minneapolis, Minnesota
Equipment:
Hangars. Hangar doors.

Hazard Insulated Wire Works,
Passaic, New Jersey
Factories:
Wilkes-Barre, Pa.
Branch offices:
Atlanta, Ga.; Boston; Chicago; Dallas, Tex.; Seattle; St. Louis; New York; Buffalo; Philadelphia; Pittsburgh; San Francisco; Los Angeles.
Equipment:
Electrical underground cable (*Armorite*).

The Heald Machine Co.,
Worcester, Mass.
Equipment:
Shop equipment (ring and cylinder grinders).

W. P. Hilliard Co., Chicago, Illinois
Equipment:
Ground radio.

Hobart Bros. Co., Troy, Ohio
E. C. Galbreath, gen. sales mgr.; C. K. Priest, adv. mgr.
Equipment:
Battery chargers.

Hoffman Specialty Company,
Waterbury, Connecticut
Equipment:
Valves. Pumps.

C. J. Hoigard Manufacturing Co.,
Minneapolis, Minnesota
Equipment:
Wind socks.

Homestead Valve Mfg. Co.,
Coraopolis (Pittsburgh District), Pa.
F. E. Schuchman, gen. mgr.
Equipment:
Cleaning machines (*Hypressure Jenny*).

Humble Oil & Refining Company,
Main & Polk, Houston, Texas
R. L. Blaffer, pres. and treas.; H. C. Wiess, executive vice-pres.; F. O. Freese, sec.; Stuart A. Giraud, gen. sales mgr.
Products:
Petroleum (gasoline; oil; grease).

Humphrey Company,
Kalamazoo, Michigan
F. A. Lemke, gen. sales mgr.
Equipment:
Hangar heaters.

I

Ideal Manufacturing Co.,
506 S. W. 2nd, Des Moines, Ia.
Ray F. Smith, pres. and sales mgr.
Equipment:
Mowers.

Ilg Electric Ventilating Co.,
Chicago, Illinois
J. M. Frank, pres. & gen. mgr.; vice-presidents: P. D. Briggs, W. H. Rietz and R. A. Ilg
Branch office:
15 Park Row, New York.
Equipment:
Heating equipment.

Ingalls Iron Works Co., Inc.,
Birmingham, Alabama
Equipment:
Hangars. Hangar doors.

Ingersoll-Rand Co., Chicago, Ill.
Equipment:
Air compressors. Air pumps.

Internatl. Business Machine Corp.,
New York, N. Y.
T. J. Watson, pres.; O. E. Braitmayer, vice-pres. & gen. mgr.; F. W. Nichol, vice-pres.
Equipment:
Accounting systems.

(*Continued on following page*)

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International Derrick & Equipt. Co.,
875 Michigan Ave., Columbus, O.
C. E. Schuler, mgr. electrical dept.
Factories:
Beaumont, Texas; Marietta and Delaware, O.; Torrance, Calif.
Branch offices:
New York; Dallas; Buenos Aires; Midland, Houston, Corpus Christi and Kilgore, Tex.; Oklahoma City and Tulsa, Okla.; Wichita.
Equipment:
Lighting equipment (towers [airway beacon; boundary light cones; acetylene beacon; ceiling light; wind cone]; field floodlight houses). Hangars (steel).

International Harvester Co.,
606 S. Michigan Ave., Chicago, Ill.
Sydney G. McAllister, pres.; Charles R Morrison, vice-pres. and director of sales; J. L. McCaffrey, gen. sales mgr.
Equipment:
Tractors (*International*; *McCormick-Deering*). Maintenance equipment (plows; mowers; levelers; mowing units for tractors; mower attachments).

International-Stacey Corp.,
Columbus, Ohio
Equipment:
Hangars.

International Steel & Iron Co.,
Evansville, Indiana
Equipment:
Hangars.

Interstate Electric Company,
St. Louis, Missouri
Equipment:
Battery chargers.

J

Jacobsen Mfg. Co., Racine, Wis.
K. F. Jacobsen, pres. & gen. mgr.; O. T. Jacobsen, vice-pres., adv. & gen. sales mgr.; E. A. Jacobsen, sec.
Equipment:
Grading and maintenance equipment (power mowers).

Jaeger Machine Co., Columbus, O.
W. C. Best, mgr. signal division; C. S. Jones, eastern representative.
Branch offices:
280 Broadway, New York.
Equipment:
Lights (neon boundary; runway; obstruction). Buoys for night water landings.

Jensen Radio Manufacturing Co.,
6601 S. Laramie Ave., Chicago, Ill.
Peter L. Jensen, pres.; A. Leslie Oliver, vice-pres.; Thos. A. White, gen. sales and export mgr.
Equipment:
Public address systems.

Johnson Airplane & Supply Co.,
Dayton, Ohio
E. A. Johnson, pres.
Equipment:
Wind socks. Fire extinguishers. Baggage trucks. (A).

Johnson & Johnson,
New Brunswick, New Jersey
Branch offices:
New Brunswick; Chicago.
Equipment:
First aid kits. (A).

K

Kaufmans, Pittsburgh, Pennsylvania
Equipment:
Uniforms.

Kellogg Switchboard & Supply Co.,
1066 W. Adams St., Chicago, Ill.
G. A. Yanochowski, pres.; J. G. Kellogg, sec.; H. C. McCluskey, treas.; H. E. Billington, gen. sales mgr.
Equipment:
Communication equipment. (A).

Kelvinator Sales Corp.,
Detroit, Mich.
G. W. Mason, pres. & gen. mgr.; Henry W. Burritt, vice-pres. chg. of sales; G. M. Evans, vice-pres. chg. of mfg.; H. G. Perkins, vice-pres.
Equipment:
Air conditioning equipment.

Kendall Refining Co., Bradford, Pa.
Products:
Petroleum (*Kendall* oil; rocker arm lubricant; grease).

Kerite Insulated Wire & Cable Co.,
30 Church St., New York, New York
Equipment:
Cable.

Kewanee Boiler Corporation,
Kewanee, Illinois
Equipment:
Hangar heaters.

Walter Kidde & Company, Inc.,
New York, New York
Aeronautical sales managers: C. L. Griffin (New York); S. G. Freck (Chicago); H. B. Teter (Cleveland); A. H. Hobelmann (Washington); R. V. Morris (San Diego).
Factory:
Bloomfield, N. J.
Branch offices:
Chicago; Cleveland; Washington.
Equipment:
Fire extinguishers (*Lux*, carbon dioxide). (A).

Killifer Manufacturing Company,
Peoria, Illinois
Equipment:
Grading and surfacing material.

Klauer Manufacturing Co.,
Dubuque, Iowa
Equipment:
Tractors.

Kleen Heat, Inc., Chicago, Illinois
Equipment:
Heating and ventilating equipment.

The Kohler Company,
Kohler, Wisconsin
Warehouses:
445 "C" St., Boston; "F" and Atlantic Sts., Philadelphia; 544 Second St., San Francisco.
Branch offices:
7 Newbury St., Boston; 435 N. Michigan Ave., Chicago; 3094 E. Grand Blvd., Detroit; 820 Merchants & Mfrs. Bldg., Houston; 1113 Wyandotte St., Kansas City, Mo.; 2152 W. Washington Blvd., Los Angeles; 751 N. Jefferson St., Milwaukee; 1100 Nicollet Ave., Minneapolis; 406 Raymond Blvd., Newark; 711 5th Ave., New York; 17th and Sansom Sts., Philadelphia; 401 Penn Ave., Pittsburgh; 120 W. Grace St., Richmond; 1538 Market St., St. Louis; 501 Post St., San Francisco; 1907 3rd Ave., Seattle; 216 Great Portland St., London, W. 1, England.
Products:
Electric generators.

Koppers Products Co.,
Pittsburgh, Pa.
R. H. McClintic, adv. mgr.
Equipment:
Surfacing material.

Kraissl Company, New York, N. Y.
Equipment:
Fuel pumps.

L

Laclede-Christy Clay Products Co.,
St. Louis, Missouri
John L. Green, pres.; W. J. Westphalen, vice-pres. and gen. mgr.; J. M. Baggot, sec.
Branch offices:
120 E. 41st St., New York; 4452 W. 5th Ave., Chicago; 630 Bassett St., Toledo; Rex Clay Products Co., 14414 Dexter Blvd., Detroit.
Equipment:
Drainage (Vitrified salt glazed clay sewer pipe; segment blocks; drain tile).

Lakewood Engineering Co.,
Columbus, Ohio
Equipment:
Lighting equipment.

LaRue Printing Co.,
Kansas City, Mo.
Equipment:
Airline tickets.

Lauterstein's, Inc.,
San Antonio, Texas
Equipment:
Uniforms.

Lights, Inc., Los Angeles, Calif.
Thayer Thorndike, pres.; Duff Willson, vice-pres.; V. Osburne, sec. and treas.
Equipment:
Lighting (floodlights; flashing marker buoys; automatic beacons).

Lear Developments, Inc.,
121 W. 17th St., New York, N. Y.
Wm. P. Lear, pres.; Irving G. Johnson, vice-pres.; W. L. Webb, chief engineer; Major J. Nelson Kelly, special representative.
Equipment:
Radio (transmitters; receivers; blind landing systems). (A).

The H. D. Lee Mercantile Co.,
Kansas City, Missouri
L. C. Stables, pres.; R. B. Caywood, vice-pres.; J. M. Mitchell, sec.; C. A. Reynolds, adv. & gen. sales mgr.
Equipment:
Uniforms.

Lincoln Engineering Company,
St. Louis, Missouri
Frank S. Barks, pres.; A. P. Fox, vice-pres.; Foster Holmes, gen. sales mgr.; J. L. Carmitcheal, equipment sales mgr.; J. C. Hurley, sales mgr., (Detroit).
Factories:
St. Louis; Detroit.
Equipment:
Lubricating equipment (compressed air, electric and manually operated; *Kleenseal* grease fittings).

Lincoln Steel Works, Lincoln, Nebr.
Equipment:
Hangars.

Lyon Metal Products, Inc.,
Aurora, Illinois
W. E. Long, sales mgr.
Equipment:
Lockers. Shop equipment (shelving; tool storage).

M

Magnus Chemical Co.,
Garwood, N. J.
W. M. Campbell, pres.; R. W. Mitchell, vice-pres.; W. M. Garbe, sec.-treas.; H. V. Mercready, adv. mgr.
Products:
Cleansing materials.

Marshalltown Manufacturing Co.,
Marshalltown, Iowa
J. M. Considine, vice-pres. (Chicago).
Branch office:
549 W. Randolph St., Chicago.
Equipment:
Pressure gauges (air; oil; steam; water). Air filters.

Maryland Metal Building Co., Inc.,
Baltimore, Md.
C. H. Michel, pres. (Baltimore); Owen C. Burgess, mgr. (New York); Eugene A. Simpson (Boston); John C. Brodt (Chicago); O. C Schlanbusch (Wilkes-Barre); A. E. Sortore (Avondale Estates); J. Young (Cumberland).
Branch offices:
30 Church St., New York; 88 Broad St., Boston; Jenvey Bldg., Cumberland, Md.; 512 S. Canal St., Chicago; Miners Bank Bldg., Wilkes-Barre, Pa.; 27 Dartmouth Ave., Avondale Estates, Ga.
Equipment:
Hangars (metal).

The Massey-Harris Co.,
Racine, Wisc.
E. F. Schiele, sales mgr.
Factories:
Batavia, N. Y.; Racine.
Equipment:
Tractors (4-wheel drive).

Martin Electric Co.,
San Antonio, Tex.
Equipment:
Lighting equipment (boundary; flood).

Midland Chemical Co.,
Dubuque, Iowa
T. C. Camm.
Products:
Service finish for hangar floors.

Fred Medart Manufacturing Co.,
Potomac & DeKalk, St. Louis, Mo.
Equipment:
Lockers.

Mercury Manufacturing Co.,
Chicago, Illinois
Equipment:
Tractors (*Banty-Quad*). Trucks (baggage, mail, express).

The Alexander Milburn Co.,
Baltimore, Maryland
Equipment:
Shop equipment (paint spray equipment). (Ja).

Mine Safety Appliances Co.,
Pittsburgh, Pennsylvania
Equipment:
First aid kits. (A).

Minn.-Moline Power Implement Co.,
Hopkins, Minneapolis, Minn.
W. C. MacFarlane, pres. & gen. mgr.; G. L. Gillett, vice-pres. & gen. sales mgr.; vice-presidents: H. B. Dinneen and N. W. Wiff.
Equipment:
Tractors. Grading and maintenance equipment (mowers).

Miss. Valley Structural Steel Co.,
Decatur, Illinois
Equipment:
Hangars.

Modine Mfg. Co., Racine, Wis.
A. B. Modine, pres.; P. H. Batten, vice-pres.; W. C. Winkel, sec.-treas.; A. G Dixon, sales mgr, heating division.
Branch office:
101 Park Ave., New York.
Equipment:
Heating equipment.

Motor Improvements, Inc.,
Newark, New Jersey
J. A. Graham, pres.; L. W. Williams, chief eng.; R. R. Layte, asst. to pres.
Equipment:
Fueling systems. (A)

Muskogee Iron Works,
Muskogee, Okla.
Equipment:
Hangars. Hangar doors.

The F. E. Myers & Bro. Co.,
Ashland, Ohio
Branch offices:
Milwaukee; Cedar Rapids, Ia.; Harrisburg, Pa.; St. Louis; Albany.
Equipment:
Pumps and pump accessories (power; water). Cleansing equipment (power). Hangar door accessories (roller bearings; tracks).

N

Nash Engineering Company,
South Norwalk, Connecticut
Equipment:
Water pumps.

National Carbide Corporation,
Lincoln Bldg., New York, N. Y.
R. C. Holcomb, service mgr.
Factories:
Ivanhoe, Va.; Keokuk, Iowa.
Equipment:
Lighting equipment (*Carbide*).

National Company, Inc.,
Malden, Mass.
Equipment:
Radio.

Nebraska Culvert & Mfg. Co.,
Wahoo, Nebraska
Equipment:
Drainage pipes.

Herman Nelson Corp., Moline, Ill.
Robert Nelson, gen. sales mgr.
Equipment:
Hangar heaters (*Univent*).

Newport Rolling Mill Company,
9th & Lowell Sts., Newport, Ky.
Equipment:
Drainage pipes.

Northwest Air Service, Inc.,
Seattle, Washington
Alan L. Blum, pres.
Equipment:
Propeller servicing equipment.

(*Continued on following page*)

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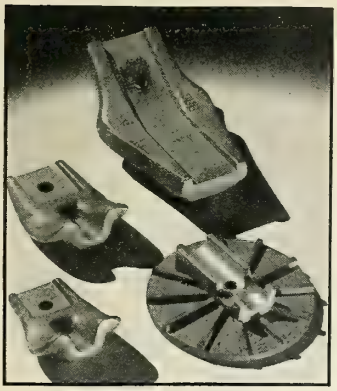

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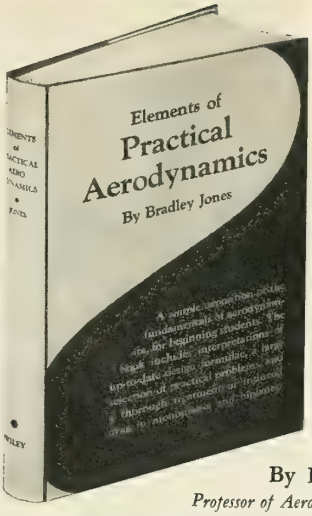

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O

Oakite Products, Inc., New York, N. Y.
D. C. Ball, pres.; H. J. Douglas, exec. vice-pres.; D. C. Smith, vice-pres.; P. B. Scarff, sr., vice-pres.
Products:
Cleansing material.

OCS Manufacturing Company, Coffeyville, Kansas
Equipment:
Lockers. Dollies. Wind socks.

The Okonite Co., New York, N. Y.
F. C. Jones, pres. & gen. mgr.; W. K. Vanderpoel, vice-pres.; J. D. Underhill, vice-pres.
Equipment:
Lighting equipment (insulated wire and cable insulating tapes)

Operadio Manufacturing Company, St. Charles, Illinois
J. McWilliams Stone, pres. and adv. mgr.; Laurence A. King, sec. and treas. in charge sales; E. E. Swick, purchasing agent; J. F. McCraigh, eng.
Branch offices:
Louisville; St. Louis; Boston; New York; Minneapolis; Los Angeles; Denver; Des Moines; Washington; Atlanta; Buffalo; Kansas City, Mo.; Dallas; Chicago; Fort Wayne.
Equipment:
Public address systems. Sound amplification systems.

Orange Car & Steel Co., Orange, Tex.
Equipment:
Hangars. Hangar doors.

Karl Ort, W. Poplar St., York, Pa.
Karl Ort, pres.
Equipment:
Wind cones. Wind tees. Trucks (baggage; service). Wheel chocks.

P

Paasche Airbrush Company, Chicago, Illinois
J. A. Paasche, pres. & gen. mgr.
Equipment:
Shop equipment (paint spray equipment). (Ja.)

Pass & Seymour, Inc., Solvay, N. Y.
Equipment:
Switches (*Despard*). Pilot lights.

Pearless Laboratories, Kansas City, Mo.
Equipment:
Meteorological equipment.

Peck, Stow & Wilcox Company, Southington, Connecticut
Equipment:
Shop equipment (shears *Pexto*). (Ja).

Penberthy Injector Co., Detroit, Mich.
C. B. Johnson, pres.; A. D. Thomas, vice-pres.; J. Heller, sec.; R. J. Houser, treas.
Equipment:
Pumps (sump).

Penn Metal Co. of Pennsylvania, Philadelphia, Pennsylvania
Equipment:
Lockers.

Penna. Aircraft Syndicate, Ltd., Wilford Bldg., Philadelphia, Pa.
E. Burke Wilford, pres., Elliot Daland, chief engineer.
Equipment:
Shop equipment (Vari-Speed).

Philco Radio and Television Corp., C & Tioga Sts., Philadelphia, Pa.
Larry E. Gubb, pres.; T. A. Kennally, gen. sales mgr.; Sayre M. Ramsdell, vice-pres. and sales promotion mgr.; R. L. Heberling, vice-pres.; Howard McDaniel, sec.; John Ballantyne, treas.
Equipment:
Radios.

The Pennzoil Company, Drake Theatre Bldg., Oil City, Pa.
R. S. King, pres.; W. S. Zehrung, vice-pres.; J. F. Vandeventer, vice-pres.; R. A. Browne, sec.; M. A. Brewster, treas.
Products:
Petroleum (gasoline; oil).

Phillips Petroleum Co., Bartlesville, Oklahoma
Frank Phillips, pres.; H. A. Trower, vice-pres. in charge of sales; K. S. Adams, treas.; A. M. Hughes, sales mgr
Products:
Petroleum (*Phillips* 77 gasoline; oil).

The Phister Manufacturing Co., 621 E. Pearl St., Cincinnati, O.
Kirby D. Frisby, eastern sales and export mgr.
Branch offices:
50 Church St., New York; 53 W. Jackson Blvd., Chicago.
Equipment:
Fire extinguishers (*Phister* carbon tetrachloride).

Plomb Tool Company, Los Angeles, California
John Larsen, in chg. of aeronautical tools.
Warehouses:
109 W. 64th St., New York; 7435 Clyde Ave., Chicago; 2825 Commerce St., Dallas; 14th & Oak Sts., Kansas City, Mo.; 925 N.W. Davis St., Portland, Ore.
Equipment:
Shop equipment (tools).

Pomona Pump Co., Pomona, Calif.
Equipment:
Water pumps.

Pump Engineering Service Corp., 12910 Taft Ave., Cleveland, Ohio
Wm. S. Jack, pres.; J. P. Johnson, vice-pres. and gen. mgr.; Wm. R. Jack, treas. Representatives: George A. Gray, Munsey Bldg., Washington; Fred Marshall, 108 Maplewood, Dayton; George W. Jack, El Cajon, Calif.; J. Corin, 2037 Oakman Blvd., Detroit.
Equipment:
Pumps (fuel; vacuum; air; oil). Fuel control apparatus.

Portland Cement Association, 33 W. Grand Ave., Chicago, Ill.
A. A. Anderson, mgr., Highways and Municipal Bureau (Chicago); Regional managers: H. R. Albion (Atlanta); J. R. Fairman (New York); C. D. Franks (Chicago); District managers: M. H. Small (Kansas City); Amos H. Potts (Los Angeles); E. M. Fleming (New York); F. J. Barrett (Seattle); L. T. Willoughby (Vancouver); Washington manager: Mark Beeman. District engineers: J. M. Marshall, Jr., (Atlanta); C. A. Clark (Austin); F. M. Chapman, Jr., (Birmingham); W. H. Steiner (Des Moines); H. J. McDargh (Indianapolis); F. S. Altman (Minneapolis); R. W. Winters (Oklahoma City); G. C. Britton (Philadelphia); C. B. Nims (Portland); H. D. Humphries (Richmond); J. E. Jellick (San Francisco); W. A. Grubb (Seattle); H. E. Frech (St. Louis); Acting district engineer: H. J. Young (Lincoln).
Branch offices:
Hurt Bldg., Atlanta; 1301 Norwood Bldg., Austin; 1015 Watts Bldg., Birmingham; 33 West Grand Ave., Chicago; 408 Hubbell Bldg., Des Moines; 610 Merchants' Bank Bldg., Indianapolis; Gloyd Bldg., Kansas City, Mo.; 321 Terminal Bldg., Lincoln; 816 W. 5th St., Los Angeles; 802 Baker Bldg., Minneapolis; 347 Madison Ave., New York; 1421 First National Bldg., Oklahoma City; 1528 Walnut St., Philadelphia; 618 S. W. 5th Ave., Portland, Ore.; 812 State Planters Bank & Trust Bldg., Richmond; 564 Market St., San Francisco; 903 Seaboard Bldg., Seattle; 1412 Syndicate Trust Bldg., St. Louis; Birks Bldg., Vancouver, B. C., Canada; 837 National Press Bldg., Washington.
Products:
Cement.

E. V. Price & Company, Chicago, Illinois
D. H. Burglund, uniform dept.
Equipment:
Uniforms.

The Pure Oil Co., Chicago, Illinois
Major D. H. Young, mgr., aviation department (Columbus).
Refineries:
Marcus Hook, Pa.; Cabin Creek Jct., W. Va.; Heath, Ohio; Muskogee, Okla.; Smith's Bluff, Tex.; Toledo; Midland, Mich.
Branch offices:
Chicago; New York; Philadelphia, Pittsburgh; Trenton, N. J.; Columbus, Ohio; Norfolk; Atlanta; Minneapolis; Des Moines, Ia.; Tulsa; Beaumont, Tex
Products:
Petroleum (*Tiolene* motor oil; rocker arm grease; gasoline).

The Pyle-National Co., Chicago, Ill.
Jack Vilas, mgr., aviation lighting dept.
Branch offices:
Grand Central Terminal, New York; Boatmen's Bank Bldg., St. Louis; Builders Exchange Bldg., St. Paul; Hobart Bldg., San Francisco.
Equipment:
Wind tees. Lighting equipment (floodlights; beacons; flashers; course lights; traffic signals; ceiling and floodlight projectors; markers; obstruction; boundary). Gasoline electric plants. Lighting accessories (light fixtures; globes; cable connection boxes; relief bushings; fittings; globe guards).

Pyrene Manufacturing Co., Newark, N. J.
E. A. Clapp, pres.; E. J. Waring, vice-pres.; E. G. Weed, vice-pres. in charge of sales and adv.
Equipment:
Fire extinguishers. (A).

Pyroil Company, LaCrosse, Wisc.
D. L. Kidder, pres.; T. B. Gantenbein, sec., treas. and gen. mgr.; K. H. Bummert, purchasing agent.
Products:
Lubricant (*Pyroil*).

Q

Quaker State Oil Refining Co., Chambers Bldg., Oil City, Pa.
S. Messer, pres.; J. D. Berry, vice-pres.; J. M. Koch, vice-pres. and gen. sales mgr.
Products:
Petroleum (*Quaker State* oil; grease).

Qualls Electric Co., South Bend, Ind.
Wm. F. Qualls, pres.; Wm. F. Qualls, 2nd, vice-pres.; H. N. Qualls, sec.-treas
Equipment:
Wind tees.

Quigley Co., Inc., 56 W. 45th St., New York, N. Y.
Products:
Cement.

R

RCA Manufacturing Company, Inc., Camden, New Jersey
David S. Little, mgr. aviation radio section; F. X. Rettenmeyer, chief aviation radio engineer; Hugh E. Allen, chief aviation radio systems engineer; Robert S. Van Cleve, commercial engineer.
Equipment:
Traffic control transmitters and receivers. Linear amplifiers. Radio-beacon attachments. Public address systems. (A).

Radio Frequency Laboratories, Inc., Boonton, New Jersey
C. B. Seabury, pres.; R. W. Seabury, Jr., vice-pres.; L. R. Damon, chief engineer.
Equipment:
Radio. (A).

Radio Navigational Instr. Corp., 500 Fifth Ave., New York, N. Y.
E. J. Simon, pres. and chief eng.; Lewis R. Compton, sec.
Equipment:
Radio direction finders.

Rand McNally & Co., Chicago, Ill.
R. A. McNally (Los Angeles); Wm. O. Tufts (Washington, D. C.).
Branch offices:
111 Eighth Ave., New York; 559 Mission St., San Francisco; 125 E. 6th St., Los Angeles; National Press Bldg., Washington, D. C.
Equipment:
Maps.

Remington-Rand, Inc., Buffalo, N. Y.
James H. Rand, Jr., chm. bd. & pres.; J. A. Zellers, vice-pres. & asst. to pres.
Equipment:
Accounting systems.

Remler Company, Ltd., San Francisco, California
F. G. Hawkinson, sales mgr.; R. B. Walder, chief engineer.
Equipment:
Amplifiers. Microphones. Speakers. Audio frequency accessories.

Richards-Wilcox, Aurora, Illinois
W. H. Fitch, pres. and gen. mgr.; Lee Mighell, vice-pres.; M. D. Jones, sec.-treas.; P. L. Hoffman, supt.
Branch offices:
New York; Chicago; Philadelphia; Boston; St. Louis; Minneapolis; San Francisco; Los Angeles; Indianapolis; Cleveland; Cincinnati; Kansas City, Mo.; Seattle; Omaha; Detroit; New Orleans; Des Moines; Milwaukee; Atlanta.
Equipment:
Hangar doors and hangar door equipment.

Richfield Oil Co. of California, 555 S. Flower, Los Angeles, Calif.
Wm. C. McDuffe, receiver in equity; R. W. Walsh, sales mgr.
Branch offices:
In all principal cities.
Products:
Petroleum (gasoline; oil).

W. A. Riddell Co., Bucyrus, O.
N. E. Jersey, sales mgr., road machinery.
Equipment:
Grading apparatus.

Roanoke Bridge & Iron Works, Roanoke, Virginia
Equipment:
Hangars. Hangar doors.

H. H. Robertson Company, Grant Bldg., Pittsburgh, Pa.
F. H. Hill, asst. vice-pres. in chg. of sales; F. C. Russell, mgr., roofing sales; Pierre Blommers, mgr., ventilator & skylight sales. Managers: J. G. Bauernschmidt (Baltimore); F. G. Peters (Buffalo); D. W. Jasper (Chicago); G. W. Anspaugh (Muncie); B. P. Slutes (Cleveland); W. E. Nichols (Detroit); L. W. von Hofen (Jacksonville); M. R. Stowell (Los Angeles); L. Y. White (San Francisco); D. W. Robertson (New York); K. B. King (Boston); F. C. Anderson (Philadelphia); G. B. Card Pittsburgh); T. B. Johnson (St. Louis); J. R. Nichols (Washington).
Factories:
Ambridge, Pa.; Sarnia, Ontario, Canada; Ellesmere Port, Cheshire, England.
Branch offices:
609 Forsyth Bldg., Atlanta; 1103 E. Main St., Richmond, Va.; 2019 6th Ave., N., Birmingham; 317 State Tower Bldg., Syracuse, N. Y.; 618 Metals Bank Bldg., Butte, Mont.; 1025 Arosa Ave., Charlotte, N. C.; Dee Bldg., Houghton, Mich.; 726 S. Ogden St., Denver; 1001 W. Drew Ave., Houston; 38 Bull St., Charleston; 409 W. Clinch Ave., Knoxville, Tenn.; 115 Center St., Little Rock; 838 N.W. 13th Ave., Portland, Ore.; 332 Pioneer Bldg., Seattle, Wash.; 311 Mills Bldg., El Paso, Tex.; 614 3rd Ave., S., Minneapolis; 348 Baronne St., New Orleans; 272 Fountain St., New Haven; 193 Middle St., Portland, Me.; 307 Dorchester Ave., S. Boston; 446 Union St., Allentown, Pa.; 103 N. 4th St., Easton, Pa.; 210 Brooks Bldg., Scranton; 214 Professional Bldg., Charleston, W. Va.; 153 W. 2nd So. St., Salt Lake City; 707 Minnesota Mutual Bldg., St. Paul; 525 National Bank of Tulsa, Tulsa.
Equipment:
Hangar building materials (protected metal roofing and sidings, weatherproof skylights) Ventilators.

Robbins & Myers, Incorporated, 1345 Lagonda Ave., Springfield, O.
C. H. Clark, gen. sales mgr.
Equipment:
Electric motors, fans. Electric and hand cranes and hoists.

(*Continued on following page*)

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W. A. Anderson, pres. and gen. mgr.; J. M. Roebling, vice-pres.; Austin C. Cooley, sec. and treas.; Walter M. Wells, asst. treas.; Harvey C. Cooley, asst. sec.; Charles C. Cooley, gen. sales mgr.; F. J. Maple, adv. mgr.
Factories:
Trenton and Roebling, N. J.
Branch offices:
107 Liberty St., New York; 51 Sleeper St., Boston; 205 W. Wacker Drive, Chicago; 223 Arch St., Philadelphia; 701 St. Claire Ave., N. E., Cleveland; 934 Avon Ave., Atlanta; John A. Roebling's Sons Co. of California, 624 Folsom St., San Francisco; 216 S. Alameda St., Los Angeles; 1032 N. W. 14 Ave., Portland; 900 First Ave., S. Seattle.
Equipment:
Aircraft wire (strand; cord). Control casing. Wire rope and fittings, slings. Insulated wire and cable Electric and gas welding wire. Serving and locking wire. (A and Ju)

Geo. D. Roper Corp., Rockford, Ill.
M. P. Roper, pres.; J. P. Curtin, sales mgr. and vice-pres.; J. A. Gaffney, asst. vice-pres.; S. H. Hobson, chief eng. Managers: R. G. Messner (Chicago); W. T. Lewis (Philadelphia); L. B. Hyde (New York); E. L. Trask (Boston); M. C. Wemple (Pittsburgh); Geo. D. Walker (Cincinnati); H. W. Conrad (Cleveland); S D Bowles (Dallas); Jerome Simer (Minneapolis); J. A. Rodems (San Francisco); J. R. Kindig (Atlanta); J. A. Strehlow (Seattle).
Branch offices:
1652 W. Ogden Ave., Chicago; 114 Liberty St., New York; 312 Stuart St., Boston; 210 Boulevard of the Allies, Pittsburgh; 1916 Young St., Dallas, Tex.; 2490 Chestnut St. San Francisco; 412 Red Rock Bldg., Atlanta, Ga.; 315 Occidental, Seattle; Lewis & Co., 709 Arch St., Philadelphia; Cincinnati Automatic Machine Co., 3120 South St., Oakley, Cincinnati; Cleveland Pump & Supply Co., 320 Rockefeller Bldg., Cleveland; Northwestern Terminal Warehouse, 2101 Kennedy St., N. E., Minneapolis; Overseas Dept., 8 S. Michigan Ave., Chicago.
Equipment:
Pumps (gasoline; oil).

Rose Aviation Corp.,
45 W. 45th St., New York, N. Y.
Equipment:
Lighting equipment.

S

A. Schrader's Son, Brooklyn, N. Y.
Division of Scovill Manufacturing Co., Inc., R. L. deBrauwere, sales mgr.; F. J. McHugh, export mgr.; managers: M. C. Stevens (Akron); G. A. Drew (Los Angeles); P. C. Evans (Detroit)
Branch offices:
705 Johnston St., Akron; 2627 Santa Fe Ave., Los Angeles; 916 New Centre Bldg., Detroit.
Equipment:
Air compressors. (A).

Seabury & Johnson,
New York, N. Y.
Equipment:
First aid kits. (A).

Sharpsville Boiler Works Co.,
Sharpsville, Pennsylvania
Equipment:
Fuel pumps.

The Shaw-Walker Co.,
Muskegon, Michigan
L. C. Walker, pres.; vice-presidents: T. E. Miller and J. J. Bourgoine (New York); C. W. Norton (Philadelphia); L. H. Rietdyk, treas.; C. E. Wilson, sec.
Equipment:
Fire protective office equipment. Lockers.

Shell Petroleum Corp.,
St. Louis, Mo.
J. H. Doolittle, mgr., aviation dept.; Rex Brashear, asst. mgr. aviation dept.; J. G. Haizlip, flying asst.; E. F. Zimmerman, research asst; Al Henshaw, sales asst.; C. R. Wood, Jr., pilot.
Products:
Petroleum (gasoline; lubricants)

Shell Oil Company,
San Francisco, California
R. M. Adamson, mgr., aviation dept.; Ray Moore, asst. mgr. aviation dept. Stanley Duncan, sales asst. (Los Angeles).
Products:
Petroleum (gasoline; lubricants).

Shell Eastern Pet. Products, Inc.,
50 W. 50 St., New York, N. Y.
Milt Hamon, mgr. aviation dept.; J. C. Tarr, asst. mgr. aviation dept.; J. L. Wheeler, sales asst.
Products:
Petroleum (gasoline; lubricants).

Simplex Electric Co.,
Indianapolis, Ind.
Earl W. Springer.
Equipment:
Radio. (A).

Sinclair Refining Co., Inc.,
630 Fifth Ave., New York, N. Y.
Managers: J. M. Woodruff (New York); A. H. Sus (Chicago); J. V. Dippel (Kansas City); W. T. Dinkins (Ft. Worth); A. F. Buck (Atlanta). Assistant Managers of Lubrication: T. L. Harrigan (New York); P. W. Zumbrook (Chicago); H. S. Turner (Kansas City); E. G. Haubold (Ft. Worth); V. J. Tuley (Atlanta).
Branch offices:
10 W. 51st St., New York; 2540 W. Cermak Rd., Chicago; 1907 Grand Ave., Kansas City, Mo.; Fair Bldg., Ft. Worth; 573 W. Peachtree St., Atlanta.
Petroleum (lubricating oil).

Skelly Oil Co., Kansas City, Mo.
W. G. Skelly, pres.; W. T. Atkins, vice-pres. marketing dept.; J. D. Powell, asst. treas.
Products:
Petroleum (gasoline; rocker arm lubricant; *Tagolene* engine oil).

Skinner Bros. Mfg. Co., Inc.,
Vandeventer Ave., St. Louis, Mo.
Equipment:
Hangar heaters.

Snap-On Tools, Inc.,
Kenosha, Wisc.
E. W. Myers, pres.; J. Johnson, vice-pres. and treas.; W. A. Seidemann, sec. and works mgr.; Rogers Palmer, gen. sales mgr.; A. H. Johnson, sales promotional mgr.; G. A. Smith, adv. mgr.; F. A. Tetzlaff, purchasing agent; G. R Gagne, chief engineer and designer. Managers: P. O. Daley (Albany); R. A. Martin (Atlanta); S. E. Tudor (Baltimore); H. B. Miller (Boston); Jos. Strassle and W. J. Springer (Brooklyn; H. J. MacMillan (Buffalo); C. W. Edwards (Chicago); R. Brinkman (Cincinnati); Geo. W. Little (Cleveland); H. E. Gage (Columbus); Mrs. E. M. White (Dallas); R. Leslie (Denver); R. B. Campbell (Detroit); O. C. Catterlin (Indianapolis); W. G. Heard (Jacksonville); F. C. Dannenberg (Kansas City); A. Oberholtz, Jr. (Los Angeles); J. F. Purdue (Milwaukee); W. J. Sharbach (Minneapolis); F. A. Hoster (Newark); I. E. Johnson (New Orleans); W. J. Glenn (New York); W. J. Sharbach and H. E. Warner (Omaha); F. A. Hoster (Philadelphia); T. N. Glenn (Pittsburgh, Buffalo, Boston and Montreal); C. L. Childrey (Baltimore and Richmond); F. H. Wendell (St. Louis); Mrs. M. I. King (San Francisco); I. W. Reimer (Seattle); F. C. Williams (Syracuse); J. Krummack (Toledo); J. B. Jardine (Montreal); H. A. Lovell (Toronto); Harold Goodwill (Vancouver); H. A. Lovell and H. Ehnebon (Winnipeg). E. D. Allmendinger, mgr., export dept. (New York).
Branch offices:
102 Quail St., Albany; 10 North Ave., N. W., Atlanta; 2407 Greenmount Ave., Baltimore; 510 Cambridge St., (Allston District), Boston; 1649 Bedford Ave., Brooklyn, N. Y.; 19 E. Utica St., Buffalo; 2025 S. Michigan Ave., Chicago; 1120 Race St., Cincinnati; 2438 Euclid Ave., Cleveland; 1437 N. High St., Columbus, O.; 2809-11 Main St., Dallas; 232 Broadway, Denver; 4450 John "R" St., Detroit; 933 N. Illinois St., Indianapolis; Box 1031, Jacksonville; 2516 Grand Ave., Kansas City, Mo.; 1845 S. Flower St., Los Angeles; 2417 W. State St., Milwaukee; 1218 Harmon Pl., Minneapolis; 429 Central Ave., Newark; 940 Poydras St., New Orleans; 7 Lenox Ave., New York; 2041 Harney St., Omaha; 1705 Fairmount Ave., Philadelphia; 7007 Kelly St., Pittsburgh; 606 W. Broad St., Richmond; 2647 Washington Blvd., St. Louis; 276 Golden Gate Ave., San Francisco; 110½ Broadway, N., Seattle; 959 S. Salina St., Syracuse, N. Y.; 1012 Jackson St., Toledo; Snap-On Tools of Canada, Ltd.: 1008 LaGauchetiere St., W., Montreal; 504½ Church St., Toronto; 1211 Granville St., Vancouver; 80 Lombard St., Winnipeg. Export dept.: 59-61 Pearl St., New York.
Equipment:
Shop equipment (wrenchs; standard hand tools; specialized equipment for aeronautical use).

Smith Acetylene & Welding Eqpt.,
Minneapolis, Minnesota
Equipment:
Shop equipment (welding apparatus).

M. L. Snyder & Son,
3rd & Arch Sts., Philadelphia, Pa.
Equipment:
First aid equipment.

Socony-Vacuum Oil Co., Inc.,
26 Broadway, New York, N. Y.
Aviation sales department: W. L. Faust, gen. sales mgr.; Sales representatives: H. W. Lake; J. S. Dexter; R. W. Brown; W. F. Holbrook. G. B. Patterson, technical asst. mgr.; H. F. Tarbox, sales engineer; L. A. McVey, adv. mgr.
Products:
Petroleum (Aero *Mobiloil;* Aero *Mobilgas; Mobilgrease*).

Southern Tailoring Co.,
New Orleans, Louisiana
Equipment:
Uniforms.

Speedway Manufacturing Co.,
1834 S. 52nd Ave., Cicero, Ill.
G. L. Newcomb, sales manager.
Equipment:
Shop equipment (portable tools; motors; automatic oilers).

Spencer Heater Co.,
Williamsport, Pa.
Chas. N. Tull, pres. & gen. mgr.; F. W. Earnest, Jr., vice-pres. & gen. sales mgr.; R. S. Pruitt, sec.
Equipment:
Heating and ventilating equipment.

Sperry Gyroscope Co.,
Brooklyn, N. Y.
C. D. Jobson, mgr., aeronautical dept.; L. N. Swisher, supt., service dept.; D. L. Garber, instructor, aeronautical school; Leslie F. Carter, instrument engineer; B. G. Carlson, gyropilot engineer; Stephen J. Zand, acoustical engineer; W. I. Selover (Los Angeles); H. S. Burtis (Seattle); J. F. McConkey (San Francisco); E. C. Weyhgandt (Chicago).
Branch offices:
58 Main St., San Francisco; 2737 First Ave., S., Seattle; 1316 W. "G" St., Wilmington (Los Angeles).
Equipment:
Lighting equipment (high intensity arc floodlights *Sperry—AGA—BBT*). (A).

Stanavo Specification Board, Inc.,
26 Broadway, New York, N. Y.
Maj. E. E. Aldrin, vice-pres. and director; D. C. Jennings, director; R. P. Resor, treas. (New York); J. H. Terry, director (San Francisco); J. B. Porter, vice-pres. and director; R. E. Wilken, director (Chicago).
Branch offices:
910 S. Michigan Ave., Chicago; 225 Bush St., San Francisco; Distributors: Colonial Beacon Oil Co., Inc., Boston; Humble Oil & Refining Co., Houston, Tex.; Pasotex Oil Co., El Paso, Tex.; Standard Oil Co. (Ohio), Cleveland; Standard Oil Co. of California, San Francisco; Standard Oil Co. (Indiana), Chicago; Standard Oil Co. (Kentucky), Louisville; Standard Oil Co. of Louisiana, New Orleans; Standard Oil Co. of Nebraska, Omaha; Standard Oil Co. of New Jersey, New York; Standard Oil Co. of Pennsylvania, Philadelphia.
Products:
Petroleum (*Stanavo* gasoline; oil, rocker arm grease; instrument oil).

Standard Fence Co.,
Oakland, Calif.
Equipment:
Fencing.

Steel Products Engineering Co.,
Springfield, Ohio
Fueling systems.
Equipment:

Stefco Steel Co., Michigan City, Ind.
Equipment:
Hangars. Hangar doors.

Stempel Fire Extinguisher Mfg. Co.,
20th & Ferry Sts., St. Louis, Mo.
Factories:
St. Louis; Philadelphia.
Branch offices:
Philadelphia; San Francisco; Seattle; Los Angeles.
Equipment:
Fire extinguishers (soda-acid; foam; carbon-tetrachloride; calcium-chloride; anti-freeze). (A).

Sterling Siren Fire Alarm Co., Inc.,
Rochester, New York
Equipment:
Sirens.

Stewart Iron Works Co., Inc.,
Covington, Kentucky
Equipment:
Fencing.

Stewart-Warner Corp., Chicago, Ill.
George Zahn, mgr., Stewart-Warner division; C. H. Dalrymple, Alemite division; J. E. Burke, export mgr.
Equipment:
Lubricating equipment (A).

B. F. Sturtevant Co., Boston, Mass.
E. B. Freeman, pres. & gen. mgr.; Noble Foss, E. B. Williams, H. F. Hagen and G. C. Derry, vice-presidents; J. F. G. Miller, vice-pres. & gen. sales mgr.
Equipment:
Heating and air conditioning equipment.

Sullivan Machinery Company,
Chicago, Illinois
H. S. Beal, pres.; E. A. Krevis, vice-pres.; H. T. Walsh, vice-pres. in charge of sales (Chicago); C. B. Officer, vice-pres. and works mgr. (Claremont); J. W. Haddock, gen. mgr. (Michigan City). Managers: T. F. Russell (Chicago); J. A. Noyes (Dallas); J. H. Emrick (Denver); E. E. Miller (El Paso); E. L. Thomas (Knoxville); R. B. Hosken (New York); W. R. Jarvis (Pittsburgh); O. J. Neslage (Salt Lake City); P. W. Olliver (San Francisco); G. P. Small (Scranton); D. M. Sutor (St. Louis); R. T. Banks (Spokane).
Factories:
Claremont, N. H.; Michigan City, Ind.
Branch offices:
1600 Bell Bldg., Chicago; 1914 Commerce St., Dallas; 1815 California St. Denver; 117 N. Kansas St., El Paso; 803 Medical Arts Bldg., Knoxville; 30 Church St., New York; 47 Terminal Way, S. Side, Pittsburgh; 117 W. 2nd South St., Salt Lake City; 145 10th St., San Francisco; 809 Linden St. Scranton; 2639-41 Locust St., St Louis; 120 S. Lincoln St., Spokane.
Equipment:
Air compressors.

T

Taylor Instrument Companies,
Ames & West Ave., Rochester, N.Y
H. J. Winn, pres. and treas.; H. W Kimmel, sec.; P. R. Jameson, directo of sales. Sales managers: F. K. Taylor W. M. Griffith.
Equipment:
Instruments (barometer; barograph thermometer; anemometer). (A).

Terrells Equipment Company,
Grand Rapids, Michiga
Equipment:
Lockers.

The Texas Co., New York, N. Y
J. D. Jernigin, Jr., mgr. aviation sales P. J. Clausen, aviation engineer; C. E Stuart, chief clerk. Aviation representatives: R. J. Hall (Chicago); H. P

(*Continued on following page*)

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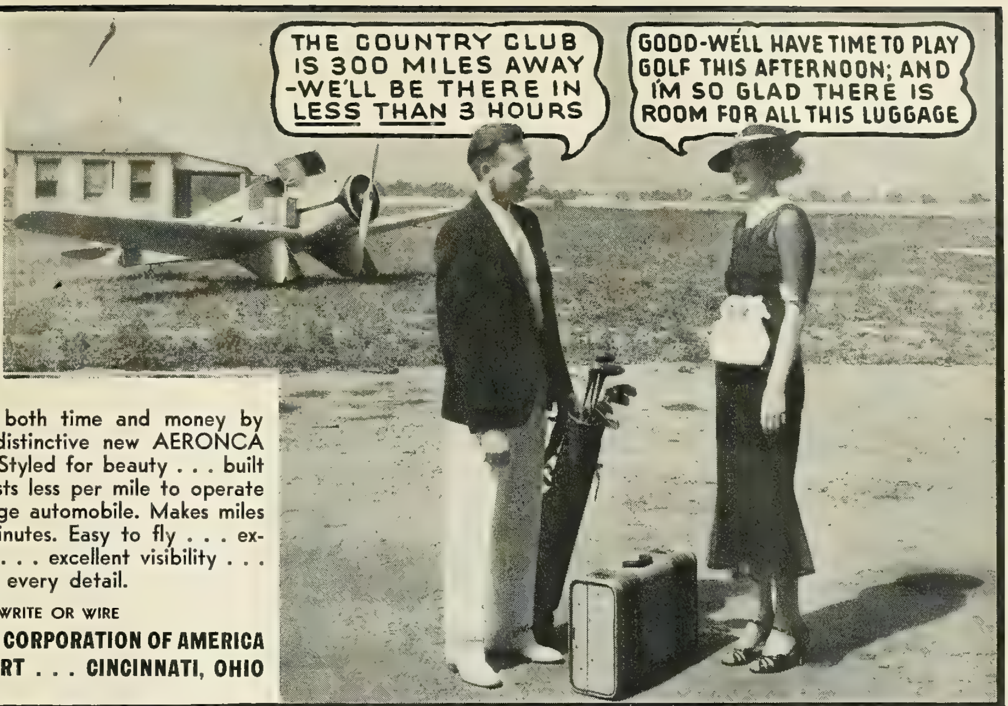
THE COUNTRY CLUB IS 300 MILES AWAY -WE'LL BE THERE IN LESS THAN 3 HOURS
GOOD-WE'LL HAVE TIME TO PLAY GOLF THIS AFTERNOON; AND I'M SO GLAD THERE IS ROOM FOR ALL THIS LUGGAGE

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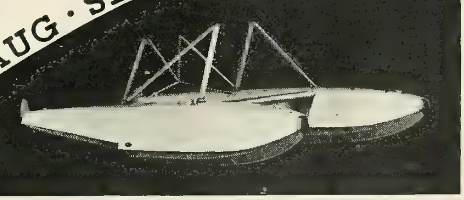

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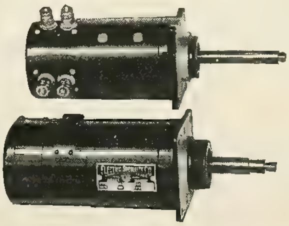

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Products:
Petroleum (*Texaco* oil; gasoline; *Marfak* rocker arm grease). Asphalt products (runways; hangar floors; aprons; dust laying).

Tokheim Oil Tank & Pump Co., Wabash Ave., Ft. Wayne, Indiana
Equipment:
Pumps (fuel; oil; air).

Toro Manufacturing Corporation, Minneapolis, Minn.
J. S. Clapper, pres.; H. C. McCartney, sec.; K. E. Goit, sales mgr.
Equipment:
Tractors. Mowing machinery.

James H. Tower Iron Works, 50 Borden, Providence, R. I.
Equipment:
Hangar door equipment (rollers).

The Trane Co., La Crosse, Wisconsin
R. N. Trane, pres.; E. H. Erickson, vice-pres.; A. T. Holmes, sec.; Frank Hood, treas.
Equipment:
Heating equipment.

Triple-A-Specialty Company, 2101-11 Walnut St., Chicago, Ill.
Equipment:
Battery chargers (*Silver Beauty*). Aircraft wire. Hydrometers. Ignition terminals. Battery accessories.

Triner Sales Company, Inc., 222 N. Bank Drive, Chicago, Ill.
J. M. Triner, pres.; F. A. Lang, gen. sales mgr. Distributors: H. C. Mitchell (New York); C. W. Hunt, Jr., (San Francisco).
Factory:
Triner Scale & Mgr. Co., 2714 W. 21st St., Chicago.
Equipment:
Triner scales.

Truscon Steel Co., Youngstown, O.
A. E. Walker, pres.; Kenneth D. Mann, executive vice-pres.; G. J. Meyer, sales mgr.; Wm. M. Kelley, plant mgr.; R. P. Dodds, adv. mgr.
Factories:
Youngstown, Ohio; Los Angeles; Cleveland.
Equipment:
Steel hangars. Steel windows. Steel doors for hangars. *Steeldeck* roofs. Open truss and *Clerespan* joists. Concrete reinforcing materials. (Ju).

C. H. Tully Fence Company, Grand Island, Nebraska
Equipment.
Fencing.

Turco Products, Inc., Los Angeles, California
Equipment:
Cleansing equipment.

U

The U. S. Air Compressor Co., 5300 Howard Ave., Cleveland, O.
R. L. Bacher, pres.; W. C. Smith, vice-pres., sec., and gen. mgr.; K. S. Clapp, director of sales; Leo Spalding, sales mgr.
Equipment:
Air compressors. Air pumps.

U. S. Electrical Tool Co., Cincinnati, Ohio
J. A. Smith, pres.; J. C. Smith, vice-pres.; Geo. E. Smith, treas.; C. D. Hogan, sec.; Geo. E. Smith, sales mgr.
Branch offices:
363 W. Peachtree St., Atlanta; 549 W. Washington Blvd., Chicago; 25 Orchard Rd., Akron; 6342 Goliad, Dallas; 509 17th St., Denver; 2832 E. Grand Blvd., Detroit; 338 W. Emerson St., Melrose, Mass.; 106 First Ave., N., Minneapolis; 50 Church St., New York; 2204 County Line Rd., Ardmore, Philadelphia; 811 Keystone Bldg., Pittsburgh; 2610 Olive St., St. Louis; 1581 Mission St., San Francisco; 516 N. 67th St., Seattle.
Equipment:
Shop equipment (electric hand drills). (Ja).

U. S. Radiator Corp., Detroit, Mich.
H. T. Cole, pres.; J. F. McIntire, vice-pres.; W. E. Mosher, vice-pres. & treas.; H. N. Booth, vice-pres., sales dept.; R. P. Henderson, vice-pres., sales dept.
Branch office:
370 Lexington Ave., New York.
Equipment:
Heating equipment.

United American Bosch Corp., Springfield, Massachusetts
Branch offices:
17 W. 60th St., New York; Stormfeltz-Loveley Bldg., Detroit; 3636 S. Michigan Ave., Chicago
Equipment:
Generators. (A)

Universal Microphone Company, 424 Warren Lane, Inglewood, Calif.
Equipment:
Public address systems.

Utica Radiator Corp., Utica, N. Y.
L. N. Murray, pres.; W. C. Murray, vice-pres. & treas.; I. L. Jones, sec.; C. A. Sawade, adv. & gen. sales mgr.
Branch office:
47-46 30th St., Long Island City, N. Y.
Equipment:
Heating equipment.

V

Valley Electric Corporation, St. Louis, Missouri
Equipment:
Battery chargers. Shop equipment (bench and pedestal grinders; electric motors).

Viele Valve Corporation, Elmira, N. Y.
Charles W. Swift.
Equipment:
Fueling system (*Viele* water locking valve).

Viking Corp., Hastings, Mich.
Equipment:
Sprinkler systems.

Viking Pump Co., Cedar Falls, Ia.
C. F. Mullens, sales mgr. (Cedar Falls); district managers: C. W. Dennis (Chicago); J. A. Sinden (Cleveland); E. E. Burton (Los Angeles); H. H. Haight (Milwaukee); F. J. Wyth (Minneapolis); Herbert Fuhrer (New York); Warner Lewis (Tulsa).
Branch offices:
549 W. Washington Blvd., Chicago; Marshall Bldg., Cleveland; 2039 S. Santa Fe Ave., Los Angeles; 2310 W. Vliet St., Milwaukee; Metropolitan Life Bldg., Minneapolis; 342 Madison Ave., New York; 1424 S. Boston Ave., Tulsa.
Equipment:
Pumps (*Viking*).

Virginia Bridge & Iron Co., Roanoke, Virginia
B. L. Sneed, vice-pres.
Factories:
Roanoke; Birmingham; Memphis.
Branch offices:
New York; Atlanta; Austin; El Paso; Los Angeles; Portland.
Equipment:
Hangars.

W

Wagner Steam Pump Co., Canton, Ohio
Equipment:
Water pumps.

Walker Cement Products, Inc., Little Ferry, New Jersey
C. W. Cade, drainage engineer.
Products:
Drainage systems (*Poroswall*).

Warner-Quinlan Co., New York, N. Y.
Equipment:
Surfacing material.

Washington Equipment Corp., Washington, D. C.
Products:
Fire extinguishers.

Wayne Company, Ft. Wayne, Ind.
Equipment:
Fuel pumps.

Weaver Manufacturing Company, Springfield, Illinois
Equipment:
Shop equipment (presses; *Weaver* electric grease gun and safety service cans).

Weidenhoff Manufacturing Co., Chicago, Illinois
Equipment:
Battery chargers.

Westco Pump Corp., Davenport, Ia.
F. S. Main, gen. sales mgr. and adv. mgr.
Equipment:
Water pumps.

Western Electric Co., New York, N. Y.
H. E. Young, gen. commercial engineer; E. W. Thurston, commercial sales engineer; H. N. Willets, radio sales engineer; F. C. McMullen, aero radio specialist; D. R. Husted; R. F. Jewett; W. L. Smith, Pacific coast representatives (7046 Hollywood Blvd., Los Angeles).
Factories:
Kearney, N. J.; Chicago; Baltimore.
Equipment:
Radio (telephone transmitters and receivers) (A).

Western Pipe & Steel Company, Bakersfield, California
Equipment:
Hangars. Hangar doors.

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pennsylvania
Branch offices:
106 S. Main St., Akron; 360 Broadway, Albany; 522 Maple St., Allentown, Pa.; 1 Bellaire Ct., P. O. Box 206, Appleton, Wisc.; 426 Marietta St., N.W., Atlanta; 2224 San Emedio St. Bakerfield, Calif.; 118 E. Lombard St., Baltimore; 2293 Broadway Ave., P. O. Box 2366, Beaumont, Tex.; 2030 Second Ave., Birmingham; 208 Bluefield Ave., Box 848, Bluefield, W. Va.; 10 High St., Boston; Bruce Ave., & Seymour St., Bridgeport; 814 Ellicott Sq., Buffalo; P. O. Box 197, Burlington, Iowa; 208 Park Ave., Burlington, Vt.; 129 West Park St., Butte, Mont.; Market & Tuscarawas Sts., Canton; 210 E. 6th St., Charlotte, N. C.; 536 Market St., Chattanooga; 20 N. Wacker Drive, P. O. Box "b," Chicago; 207 W. 3rd St., Cincinnati; 1216 W. 58th St., Box 5817, Cleveland; Gay & 3rd St., Columbus, O.; 209 Browder St., Dallas; 206 E. 2nd St., Davenport, Iowa; 30 N. Main St., Dayton; 900 Fifteenth St., Denver; 523 6th Ave., Des Moines; 5757 Trumbull Ave., Detroit; 10 E. Superior St., Duluth; P. O. Box 764, Eastport, Me.; 338 E. Water St., Elmira; 303 N. Oregon St., El Paso; 5815 Peladeau St., Emeryville, Calif; 1003 State St., Erie, Pa.; 201 N.W. 1st St., Evansville; 602 Cleveland Ave., Fairmont, W. Va.; 1010 Packard Ave., Fort Wayne; 501 Jones St., Fort Worth; 701 Washington St., Gary, Ind.; 507 Monroe Ave., N.W., Grand Rapids; W. Earle St., P. O. Box 1591, Greenville, S. C.; 235 16th St., Hammond, Ind.; Main & Pearl Sts., Hartford; 1314 Texas Ave., Houston; 209 Ninth St., Huntington, W. Va.; 539 Madison Ave., Indianapolis; 433 High St., Ishpeming, Mich.; 212 W. Michigan Ave., Jackson; 47 Messenger St., Johnstown, Pa.; 2124 Wyandotte St., Kansas City, Mo.; Gay & Clinch St., Knoxville; 1115 W. 24th St., P. O Box 1052, Little Rock; 420 S. San Pedro St., Los Angeles; 322 W. Broadway, Louisville, Ky.; 508 Edgewood Ave., P. O. Box 228, Madison; 202 W. Merritt St., P. O. Box 442, Marshall, Tex.; 130 Madison Ave., Memphis; 1036 N. Miami Ave., P. O. Box 590, Miami; 546 N. Broadway, Milwaukee; 2303 Kennedy St., N.E., Minneapolis; 1610 N. Fourth St., Monroe, La.; 219 N. 2nd Ave., Nashville; 1180 Raymond Blvd., Newark; 42 Church St., New Haven; 333 St. Charles St., New Orleans; 150 Broadway, New York; 205 Falls St., Niagara Falls; 254 Tazewell St., Norfolk, Va.; 10 E. California St., Oklahoma City; 409 S. 17th St., Omaha; 104 E. State St., Peoria; 3001 Walnut St., Philadelphia; 11 W. Jefferson St., Phoenix, Ariz.; 435 7th Ave., Pittsburgh; 27 Deerfield Rd., P. O. Box 1797, Portland, Me. 309 S. W. 6th Ave., Portland, Ore.; 16 Elbow St., Providence; 803 N. Person St., Raleigh, N. C.; Fifth & Byrd, Richmond; 410 Atlantic Ave., Rochester, N. Y.; 130 S. 2nd St. Rockford, Ill.; 719 "K" St., Sacramento; 10 W. 1st South St., Salt Lake City; 212 E. Houston St., San Antonio; 1 Montgomery St., San Francisco; 603 Stewart St., Seattle; 2311 George St., Sioux City; 216 E. Wayne St., South Bend; 158 Monroe St., Spokane; 130 S. Sixth St., P. O. Box 37, Springfield, Ill.; 395 Liberty St., Springfield, Mass.; 411 N. Seventh St., St. Louis; 420 N. Geddes St., Syracuse; 1023 "A" St., Tacoma; 417 Ellamae Ave., Tampa; 245 Summit St., Toledo; 303 E. Brady St., Tulsa; 113 N. Genesee St., Utica; 1434 New York Ave., N.W., Washington; 328 Jefferson St., P. O. Box 416, Waterloo, Iowa; 400 S. Emporia St., Wichita; 267 N. Pennsylvania Ave., Wilkes-Barre, Pa.; 32 Southbridge St., Worcester; 143 S. George St., York, Pa.; 25 E. Boardman St., Youngstown, O.
Equipment:
Lighting equipment (alidades; beacons; code flashers; floodlights; luminaires; lamps; marker lights; searchlights; wind indicators; power generating, control and distribution equipment, gas electric sets; no fuse panelboards). Air conditioners Electric refrigerators. Water coolers. Battery chargers. Arc welders. Electrical equipment (fans, etc.). (A, Ja and Ju)

Weston Electrical Instrument Corp., Frelinghuysen Ave., Newark, N. J.
E. F. Weston, pres.; Caxton Brown, vice-pres. and sec.; Earl R. Mellen, treas.; H. D. Gerstenberger, sales mgr.
Equipment:
Instruments. (A).

Wheeler Bridge & Lbr., Hubbell Bldg., Des Moines, Iowa
Equipment:
Drainage piping.

White Star Refining Co., Detroit, Michigan
Products:
Petroleum (gasoline; oil).

Wissler Instrument Company, St. Louis, Missouri
Equipment:
Instruments (clinometer).

Wolverine Empire Refining Co., 51 Madison Ave., New York, N. Y.
C. H. Ellingwood, pres.; A. W. Scott, vice-pres.; F. W. Baer, sec.-treas.; H. Landsberger, Jr., sales mgr.
Products:
Petroleum (*Wolf's Head* oil).

Worthington Pump & Mchry. Corp., Harrison, New Jersey
H. C. Beaver, pres.; C. E. Searles, vice-pres. in chg. of sales; E. T. Fishwick, C. E. Wilson and H. C. Ramsey, vice-presidents: C. N. Barney, sec.-treas. Worthington-Gamon Meter Co.: E. T. Fishwick, pres.; G. H. Gleeson, vice-pres. in chg. of sales; C. E. Searles, vice-pres.; Carbondale Machine Corp.: H. C. Ramsey, pres.; A. H. Baer, vice-pres. in chg. of sales: H. A. Feldbush, vice-pres.
Factories:
Buffalo, N. Y.; Harrison, N. J.
Branch offices:
Worthington-Gamon Meter Co., Harrison; Carbondale Machine Corp., Harrison.
Equipment:
Worthington Pump & Machinery Corp.: Pumps. Air conditioners (stationary and portable). Steam powered plant equipment. (Ja). Worthington-Garmon Meter Co.: Meters (water; gasoline; oil; grease). Carbondale Machine Corp.: Air conditioners. Refrigeration compressors and condensers. Drinking water systems.

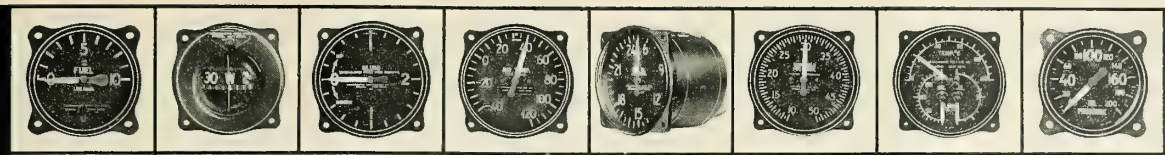
Y

Yale & Towne Mfg. Co. (Philadelphia Division), 4530 Tacony St., Philadelphia, Pa.
Equipment:
Shop equipment (chain hoists and monorails). (Ja).

York Heating & Ventilating Corp., Philadelphia, Pennsylvania
Equipment:
Hangar heaters.

Z

Zenith Radio Corp., Chicago, Ill.
E. A. Tracey, gen. sales mgr.
Equipment:
Radio.



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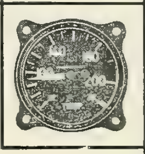

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Sales Representatives: Air Associates, Inc., New York, Chicago, Los Angeles

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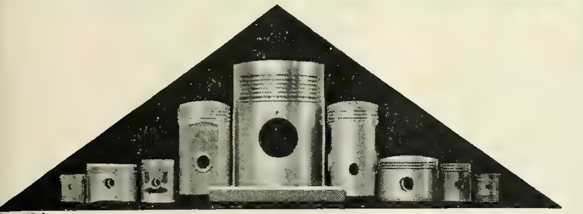

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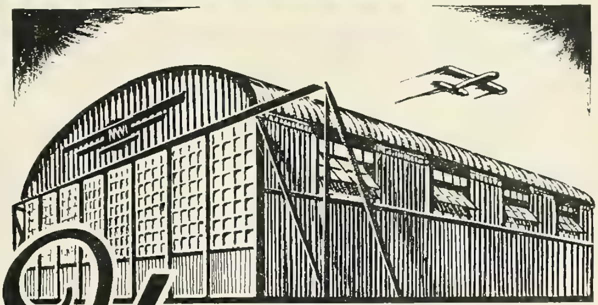

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DIGEST OF THE NEWS

AIRPORTS

Weather Reporting

More exact weather predictions may be expected soon as the result of steps taken last month at the Chicago weather bureau to double existing service. Allowing time to train new men and perfect arrangements for receiving more than 100 reports twice daily from as many weather stations throughout the country, C. A. Donnel, principal Chicago meteorologist, does not expect to have the new service in operation before October 15.

At present there are weather forecasts every twelve hours for the public and every six hours for pilots. Aviation forecasts are being made by nine men at the Municipal Airport, and are based mostly on data received at the main office of the Courthouse in the Loop. This means that the reports as now furnished at the airport are based largely on data 6 hours old.

When the new service is started the 3 p.m. and the 3 a.m. airway reports will come direct from information received from the weather stations throughout the country and routed through the main office in Chicago.

Personnel Notes

Airport lighting was discussed Sept. 3 on the closing day of the 30th annual convention held in Buffalo, N.Y., of the Illuminating Engineering Society. Papers were presented by F. C. Breckenridge, Bureau of Standards, Department of Commerce, on *The Airport Lighting Specifications of the Department of Commerce*, and H. C. Ritchie, General Electric Co., Schenectady, on *Recent Developments in Aviation Lighting.*

* * *

B. M. Doolin has resigned as regional airport supervisor for the western states to devote all his time to managing Mills Field, San Francisco.

Improvements

Chesapeake, Ohio. Huntington-Ironton - Chesapeake Airport; drainage; grading; construction of two concrete runways; $95,000 WPA project.

Galveston, Tex. Municipal airport; new runways; contract to W. A. Kelso Material Co., $12,420.

Little Rock, Ark. Municipal airport; concrete runaways, 3500′× 150′. $150,000. WPA and city project.

North Platte, Neb. Municipal airport; general improvements; $85,000. WPA and city project.

San Francisco, Cal. Mills Field; additional 110 acres purchased, $105,000; 3000′ concrete runway completed; new administration building, $140,000; floodlight installed; seaplane base. $3,000,000 WPA project.

Sherman, Tex. Municipal airport; two concrete runways—N-S 2500′×100′, NE-SW 1500′×100′. $35,312 WPA, $13.188 city.

Washington, D. C. 100,000 sq. yds. concrete runways, taxi strips, aprons; renovation of lighting and drainage systems. $100,000.

PRIVATE FLYING

Reserve Convention

Committees to direct plans for the annual convention of the National Air Corps Reserve in Oklahoma City, Okla., October 8 and 9 were appointed at a meeting of the Oklahoma City chapter and representatives of the Army and Navy Club. Chairmen are Moss Patterson, finance; R. E. Durkee, arrangements and entertainment; B. S. Graham, special; Maj. Gen. Charles E. McPherren and Clarence E. Page, publicity.

Events

25,000 persons witnessed an air show marking the third annual New Philadelphia, Ohio, air day. Program featured aerobatic flying by Lieut. Joe Mackey and Mike Murphy. Others participating were W. Myron Hightower, Ed Leach, Earl Stein and Maj. Fred L. Smith, state director of aeronautics.

The same group of pilots performed before a crowd estimated at 75,000 at Ford Airport, Chicago, Ill., and before 35,000 at the Evansville, Ind., Municipal Airport for the fifth annual Evansville Air Day.

Personnel Notes

Julian Martin has been elected president of the Birmingham Aero Club. Other officers are: Birger Thele, Edmund Armes, and Homer Panter, vice-presidents; Dave Denny, secretary-treasurer; Mildred Proctor, recording secretary; Hayden Brooks, Sam Clabaugh, Kathryn Oliver, Tom Oster, Brown Hill, F. M. Jackson, P. Y. Whitman, Dr. L. A. Tatum, Bob Sims, B. A. Schroeder, and Harry Frazier, members of the board of governors.

* * *

Officers of the University of Virginia Aviation Club for next year are W. R. Franke, pres., and A. G. Arundale, vice-pres. Those of Gliding Division No. 1 of the club are Arundale, chairman, and B. P. Molten, vice-chairman.

"Cub" Activities

Cub Convoy will leave Atlanta, Ga., December 8, flying in formation to Miami to attend the Miami Air Races in a group. Indications are that there will be about 20 to 25 Taylor *Cubs* in the group.

There will be several features of interest to *Cub* pilots at Miami, including the 40 hp race which will be held on December 10.

AIR SERVICE

Hensley Construction

Authorization of funds for the beginning of work on the $372,558 improvement project for Hensley Field, army field at Dallas, has been received and work will commence soon. First unit of the work will be construction of present runways to their original 8-inch thickness and topping them with asphalt. Then the work of doubling the width of the present E-W runway to 200 ft. will be started. Next a SE-NW runway will be constructed, this being longer than either of the present runways, having a stone foundation and topped with asphalt. The project has been allotted $362,558 by the Federal government, the city of Dallas contributing the other $10,000 for supervision and drawing the plans.

Reserves Train

Twenty-seventh Division Aviation, N.Y.N.G., has just completed a successful tour of field training at Pine Camp, N.Y., its summer base. According to Major Larry Brower, commander, instruction in instrument flying was given preference over other training. The squadron is looking forward to the receipt of 8 new Douglas O-46's which will be delivered in the immediate future. This, coupled with the rebuilding of the field and quarters at Miller Field, will be an important factor in increasing flying activity by the group.

(*Continued on following page*)

Personnel of the 27th Division Aviation, New York National Guard, commanded by Maj. Larry Brower (center)

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ENGINES:

CYCLONES, Model SR1820-F2, new, 735 H.P. List price $8120; net each.	$6000
CYCLONE, Model SR1820-F52, 820 H.P. Same as new. List price $8600; net	6000
CYCLONE, Model SR1820-F1, 650 H.P. Practically new	3000
HORNETS, Model 1860B, geared, 575 H.P. 38 hours total time. Each..	1000
HORNETS, Model 1860B, direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each	1650
HORNETS, Model 1690A, 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each	1000
WASP SC1's—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each....	1650
WASP C's—420 H.P. Under 500 total hours; overhauled and modified. Each	1350
WASP B's—420 H.P. Under 600 total hours; overhauled and modified. Each	850
WRIGHT R975-A's, with D modifications — 330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each	1250
WRIGHT R760-E's — 250 H.P. Majored and modified by Wright distributors. Each	1250
WRIGHT J-5's—220 H.P. Moderate usage; majored. Each	500
LYCOMING R-680—215 H.P. Majored and modified by Lycoming distributors	550
KINNER B-5—125 H.P. Newest type; factory rebuilt, with new engine guarantee	850
KINNER R-5—160 H.P. Few total hours—like new	850
KINNER K-5—100 H.P. Front exhaust. Same as new	650
KINNER C-5—210 H.P. Under 400 total hours; majored and modified.	450

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Following Engines in "As Is" Condition
All average under 500 total hours:

No.	Type	Price Each
27	HORNET A-1's—525 H.P.	$500
18	HORNET B's—575 H.P.	850
25	WRIGHT R975's—330 H.P.	675
40	CURTISS D-12's—400 H.P.	500
18	CURTISS CONQUERORS — 600 H.P.	500
3	AXELSONS—150 H.P. 7 cylinder, air cooled	150
1	CHALLENGER—185 H.P.	195

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(Continued from preceding page)

Coast Guard Transfer

Temporary transfer of the Coast Guards' air border patrol from San Antonio to Del Rio, Tex., for 45 days has been authorized to determine the advisability of making a permanent transfer.

Lieut. Comdr. N. M. Nelson, in charge of the detachment at Dodd Field, will submit a report covering operations along with his recommendations. Purpose of the detachment is to patrol the Texas-Mexican border to prevent smuggling and also to assist other departments of the government. Del Rio is on the border and somewhat centrally located on the Texas-Mexican line.

SCHOOLS

Enrollments

Casey Jones School of Aeronautics, Newark, N. J., has again brought its enrollment up to capacity of 400. In the future replacements are only being made as students graduate and a waiting list is being established to fill these vacancies. Next vacancies in the aeronautical engineering class will occur in March 1937 and in the master mechanics course there are a few openings in the class of November 23rd.

* * *

Recent enrollments at Spartan School of Aeronautics, Tulsa, are far ahead of the last few years and most of the new students are enrolling in the longer and more complete transport courses according to Director J. D. Green.

Expansion

A new dormitory, the fourth on the campus, and which will have accommodations for 24, is under construction at Parks Air College. For use in advance flight training, the school has arranged for delivery of a Lambert Monocoach as soon as the ATC is secured.

Activities

Students of the Metals Division, Boeing School of Aeronautics, are building a low-wing, all-metal, high-speed trainer of original design. This two-place cabin land monoplane incorporates new ideas in light plane construction. The airplane was designed by Instructor John W. Thorpe with the assistance of other members of the Boeing School Engineering Department.

* * *

According to Chas. A. Warren, president of the Warren School of Aeronautics, credit for efficient handling of field service work at the National Air Races goes to the large number of his students who were selected by him under the direction of the Executive and Technical Committees of the races and who served both the north and south fields at Municipal airport.

All-metal Whirlwind-powered Curtiss training plane

New Courses

High schools in San Francisco are offering free courses in aeronautics at Galileo Evening High and Humboldt Evening High. Subjects covered include history of aviation, nomenclature, aerodynamics, planes and engines, Bureau of Air Commerce regulations, instruments, airline procedure, navigation and meteorology.

* * *

The first airplane mechanics courses in Virginia operated by the State Board of Education and the Prince Edward Co. School Board has been opened at the Farmville School of Aeronautics. W. A. Stonnell is manager of the school, which offers free mechanics instruction for the airplane or engine license.

AIRLINES

Schedule Revisions

Air sleeper service between New York and Los Angeles was inaugurated last month by American Airlines, marking the introduction of a three-stop transcontinental service by a regular airline. Schedules are flown on a 17-hour 41-minute service.

American Airlines also inaugurated direct passenger service between Curtiss Airport, E. St. Louis, Ill., and Chicago, the new round trip between these cities being an addition to the four flights a day in each direction between Lambert-St. Louis Airport, St. Louis, Mo., and Chicago.

* * *

Transcontinental and Western Air, Inc., inaugurated fastest transcontinental flying schedules yet attempted with the departure at 6:15 p.m. of its Sky Chief for a 16 hour and 59 minute run to Los Angeles, thirty-five minutes less than the former scheduled time for this route. Elimination of some intermediate stops and quicker handling of planes on the ground have made the speeded-up service possible. Similar time-saving has been effective on other schedules of the transcontinental and New York-Chicago system.

* * *

Connections to and from the Atlantic and Pacific coasts for Tulsa, Oklahoma, and its vicinity are now available through a new service offered by Hanford Airlines in conjunction with the coast-to-coast system of TWA. Hanford's new Lockheed Electras are operating passenger, mail and express service between Kansas City and Tulsa with schedules closely approximating those of the TWA skyliners, operating through Kansas City.

483,712 Passengers

Scheduled airlines of the United States continued to gain in miles flown, and in passengers, mail and express carried during the first six months of 1936. The 33,523,075 miles flown, 483,712 passengers, 204,501,624 passenger miles, 3,548,075 pounds of express and 8,297,885 pounds of mail all were increases over the corresponding totals for the first half of 1935.

The lines had 422 airplanes in service, employed 692 pilots, 432 co-pilots, 2,714 mechanics and riggers, 1,535 other hangar and field personnel, 264 hostesses, 41 stewards and 3,392 office workers, giving employment to a total of 9,070 persons. They used 17,008,034 gallons of gasoline and 405,977 gallons of oil.

On the domestic lines only, miles flown totaled 29,078,403; passengers carried were 421,519; passenger miles flown, 179,503,354; and express carried, 2,911,775 pounds.

The domestic lines had 49,191 flights scheduled, of which 45,676 were started. There were 2,066 extra sections flown, and the total number of trips completed was 45,150. Of the trips scheduled, the airlines started 92.85%. Of all trips scheduled plus extra sections, 88.09% were completed. Of trips started 94.57% were completed.

The average speed for all the domestic air lines was 147.5 mph, and the average length of a passenger's trip was 425.8 miles. Of seats which were available, 59.33% were used.

* * *

During July scheduled airlines carried 110,690 passengers, a new record for passengers carried in a month, and the first time the total for the domestic lines had passed 100,000 in a month. The new record follows upon record-breaking passenger totals in May and June.

The lines also carried 613,837 pounds of express and flew 6,024,518 miles.

Gasoline Contract

United Air Lines has purchased a three-year supply of gasoline, involving a minimum of 27,000,000 gallons from Standard Oil Companies of California, Indiana, New Jersey and Ohio. President W. A. Patterson said it was the equivalent of 3375 tank cars of gasoline, and is the largest fuel contract ever placed in the history of air transport.

The fuel will be delivered in airports in 37 cities in 15 states between the Atlantic and the Pacific seaboards, and at Pacific coast air terminals. The company will soon increase its fuel consumption when it puts into service the new 21-passenger twin-engined Douglas transports.

Coming Events

National Aircraft Production Meeting, SAE, Ambassador Hotel, Los Angeles, Cal., Oct. 15-17

●

Eighteenth annual convention, American Society for Metals, Cleveland, Ohio. Oct. 19-23

●

Third annual convention Air Line Pilots Association, Shoreland Hotel, Chicago, Ill. Oct. 19

●

Paris-Saigon round-trip speed race, sponsored by Aero Club of France. October 25

●

International Aviation Show, Grand Palais, Paris, France. November 13-29

Combined Aviation and Auto Show, Kansas City Auditorium. Sanctioned by Aeronautical Chamber of Commerce. Nov. 21-29

●

Aircraft Show, Miami Municipal Airport, Miami, Fla. Dec. 6-12

●

"Cub Convey" for Miami Air Races takes off from Atlanta, Ga. Dec. 8

●

Ninth Annual Miami All-American Air Maneuvers, Municipal Airport. Dec. 9-12

●

National Aircraft Show, auspices Aviator's Post 743, American Legion, Grand Central Palace, New York. N. Y. Jan. 28-Feb. 6, 1937

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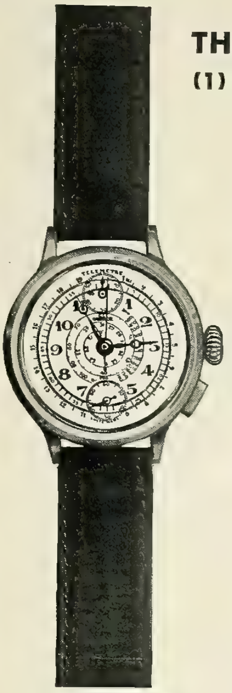

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THE INDUSTRY

Production Gains

Aircraft and engine production, according to Aeronautical Chamber of Commerce reports, showed a sharp increase in number of units for the first six months of this year, 1158 airplanes and 1954 engines being manufactured compared with 597 airplanes and 1136 engines in the same half of 1935.

Commercial plane production value, however, was 4.7% under the corresponding period of 1935, the decrease resulting because 37 multi-engined cabin planes were produced during the period compared with 67 in the January-June period in 1935. Open cockpit biplanes also showed a decrease in units, but single-engined cabin biplanes and monoplanes, seaplanes and amphibions increased.

Military airplane production reached 496 units.

New Building

Further enlargement of plant facilities of the Boeing Aircraft Co. is now under way with the construction of a new hammer shop building. The building will measure 90 × 120 ft., bringing plant area to a total of 408,550 sq. ft. Seven drop hammers will be placed immediately in operation, and foundations will be provided for a total of eleven. Space will be provided for modeling, die casting and finishing, storage of dies, and bench work, in addition to the operations of the hammers themselves. An overhead crane system will also be installed.

The Austin Company is in charge of construction of the new Boeing building.

$11,639,450 Exports

Exports of aeronautical products for the first seven months of 1936 showed a sharp increase over the same period last year, $11,639,450 being realized from the sale abroad of 294 planes and 409 engines in addition to more than $3,000,000 worth of accessories. Sales for the comparable period in 1935 totaled $8,818,096.

Most business thus far in 1936 was consummated with buyers in China, $4,310,480 worth of materials being imported there. Next best customer was Argentina where $1,171,486 worth of equipment was sold.

Personnel Changes

Mrs. Phoebe Fairgrave Omlie has resigned as special assistant for Air Intelligence of the NACA with additional duties as liaison officer between the committee and the Bureau of Air Commerce.

* * *

William F. Wise, former sales manager of Ex-Cell-O Aircraft & Tool Corp., has been appointed president of Republic Products Corp., Detroit. In addition, R. B. Criddle has been appointed secretary-treasurer of the corporation.

* * *

Milford F. Vanik, of the Curtiss Aeroplane & Motor Corp., has been named head of the aeronautics committee of the Buffalo (N. Y.) Junior Chamber of Commerce.

* * *

Gene Collins of Dallas was named a member of the aviation committee of the U. S. Junior Chamber of Commerce. Collins is one of the thirty-three placed on the committee by the national organization.

* * *

George I. Wright has been appointed transportation sales and division manager of the Westinghouse Electric and Manufacturing Co.

* * *

Ralph Fisher, formerly of th Houdaille-Hershey Corp., ha been appointed sales manager the Stamping (Eaton Detro Metal Co.) and Bumper Divisio of Eaton Manufacturing Co.

Business Reports

Directors of the Curtiss Wright Corp. called a speci meeting of stockholders who wi be asked to vote on the dissol tion of five of its subsidiaries, i cluding Curtiss Aeroplane & Mo tor Corp., Curtiss-Wright Ai ports Corp., Curtiss Capro Corp., and the Curtiss Wrigh Airplane Companies of Missou and Delaware. Savings in opera tions are expected if stockholde approve plans now being pro posed to them.

* * *

Net profits of $40,213 after fed eral normal income taxes, ha been reported by Lockheed Ai craft Corp. for the six month ended June 30. Sales for th period totaled $660,975 and un filled orders on hand were $1 250,000 which compares wit $525,000 a year ago.

Digest of Recent Events

Beryl Markham Makes Solo Ocean Crossing

The first east-west solo crossing of the Atlantic by a woman was completed when Mrs. Beryl Markham landed near Baleine, Nova Scotia, 24 hours 40 minutes after leaving Abington, England, on a projected flight to New York. Mrs. Markham flew a Percival *Vega Gull* low-wing monoplane. The western terminus of the flight was planned to be Floyd Bennett Field in New York, but headwinds caused excessive fuel consumption which necessitated a landing after about 2000 miles of the 3700-mile flight had been completed. SEPT. 5

Louise Thaden Sets Transcontinental Mark

Flying as a contestant in the Bendix Trophy Race from Floyd Bennett Field to Los Angeles, Louise Thaden set a women's transcontinental speed record of 14 hours 55 minutes 1 second. Accompanied by Blanche Noyes and flying a Wright-powered Beechcraft, Mrs. Thaden clipped about 4 hours from Laura Ingalls previous record. SEPT. 7

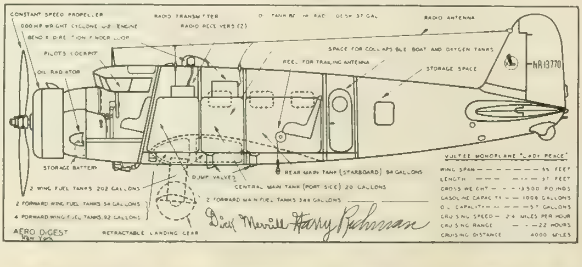
Maurice Arnoux Flies 248 MPH Over 1000 Kilometers

Maurice Arnoux added another record to his list when in a Renault-powered Caudron he established a 1000-kilometer speed record with an average of 400.29 kph (about 248.58 mph). Arnoux was flying a plane similar to the one in which Michel Detroyat won the Thompson Trophy at Los Angeles. The previous 1000-kilometer record was 310.99 kph (193.12 mph). SEPT. 9

Soviet Fliers End Trip From U. S. to Moscow

A 10,000-mile aerial exploration flight to Moscow from Los Angeles was completed when Sigismund Levanevsky and Victor Levchenko landed at Moscow after flying over the northern route between the two continents. For their flight, designed to establish a tentative aerial route between the Soviet Union and the United States, the pilots used a Cyclone-powered Vultee. Their last lap was from Sverdlovsk in the Ural Mountains to Moscow, about 1000 miles east. SEPT. 13

Outline and view of the Wright-powered Vultee in which Richman and Merrill flew the Atlantic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NR13770
STORAGE BATTERY
DUMP VALVES
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CENTRAL MAIN TANK (PORT SIDE) 20 GALLONS
2 WING FUEL TANKS 202 GALLONS
2 FORWARD MAIN FUEL TANKS 344 GALLONS
2 FORWARD WING FUEL TANKS 54 GALLONS
4 FORWARD WING FUEL TANKS 92 GALLONS
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Dick Merrill Harry Richman
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WING SPAN — 55 FEET
LENGTH — 37 FEET
GROSS WEIGHT — 13500 POUNDS
GASOLINE CAPACITY — 1008 GALLONS
OIL CAPACITY — 57 GALLONS
CRUISING SPEED — 214 MILES PER HOUR
CRUISING RANGE — 22 HOURS
CRUISING DISTANCE 4000 MILES
Lady Peace

German Flying Boats Start Trans-Oceanic Flights

Two Deutsche Lufthansa D 18 flying boats, the *Zephyr* an the *Aeolus* successfully inaugu rated experimental trans-ocean service when they flew from th Azores to New York after bein catapulted from the mothersh *Schwabenlund* anchored at a poi near the Azores. The *Zeph* made the 2830-mile flight fro the Azores to New York no stop. SEPT.

Richman-Merrill Make Fast Trans-Atlantic Crossings

Leaving Floyd Bennett Field, Y., in the Wright Cyclone-po ered Vultee, *Lady Peace*, for non-stop flight to London, Har Richman and Dick Merrill land at Llangadock, South Wal about 175 miles from their go after averaging about 200 m at about 11,000 ft. all the w across the ocean to set a ne speed record between the tv continents. Remaining abroad f a few days, the pilots started return flight and after again se ting a speed record for the cros ing landed in Newfoundland wh they ran out of fuel. After min repairs, the plane was flown Harbor Grace from where t round-trip flight to Floyd Benn Field was completed. The ea west trans-Atlantic crossing w completed in 16 hrs. SEPT.

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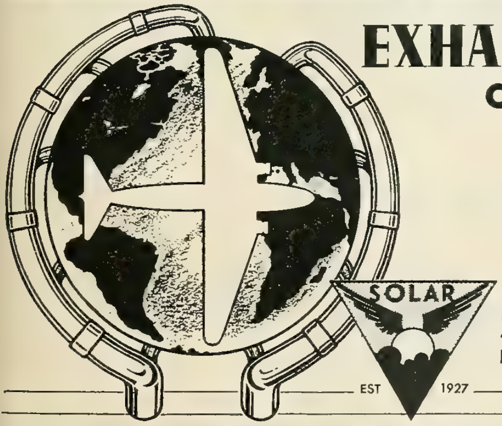

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FOREIGN NEWS IN BRIEF

●

Australasia

Civil Aviation Board has completed plans for air navigation aids and will submit the plans to Cabinet for approval. The new system will be a combination of radio beams and rotating light beacons at airports in every capital city; radio direction finding stations at key points along the regular routes; distinguishing light beacons at all main landing fields; and radio marker beacons at capital cities and other points. The board has decided that all commercial and mail aircraft must be equipped with radio receivers and other necessary apparatus for use on the system. Apparatus will be manufactured in Australia, and it is expected that installation will begin this month, the Sydney-Melbourne-Tasmania route being the first to be completed.

Adelaide Airways, Ltd., operating between Melbourne and Adelaide have increased service from three flights weekly in each direction, to a daily service, the schedule being arranged so that passengers from Sydney to Melbourne can make connection at Essended. The Adelaide-Broken Hill service was extended to Melbourne, service being on a tri-weekly basis, three in each direction.

Night air mail operations between capital cities in Australia are reported to be operating next August, coinciding with flying-boat mails to Britain. Mails will be carried without surcharge. Lighting, radio and beacons are now being installed.

Negotiations are still proceeding between Australian officials, K.L.M. and Air France to reach an agreement for the extension of these two lines to Australia. It is understood that should an agreement be reached, Air France will continue on to French possessions in the Pacific.

Australian National Airways, Ltd., has established a school at Melbourne where its pilots can receive instruction on new advancements, etc.

Canada

Report of Canadian Airways, Ltd., for the six months ended June 30 reflects to a substantial degree airplane activity in the intense mining development now under way in Canada. Every plane in the company's service was fully occupied in northern freighting during the half year, while increase in passenger traffic to the Western Ontario and Manitoba mining areas was the determining factor in the placing of two new Lockheed Electras in these areas.

The Canadian National Exhibition included more aviation exhibits this year than has been the case for several years, with Aeronca and Canadian-made Taylor *Cub* planes, as well as a large display by Imperial Airways. The *Cub* exhibit was partly of a manufacturing nature with wings being built at the exhibit to show the public how this is done today. Among other things, Imperial Airways featured sectional models of the new Empire planes. In addition there were models of the Mayo Composite trans-Atlantic plane.

Contract for the construction of a $97,990 hangar at the Royal Canadian Air Force station, Rockcliffe, Ontario, has been awarded to H. Dagenais, Ltd., Ottawa.

Koolhoven Junior FK-53, a light cantilever monoplane with a 55 hp Mikron engine giving a top speed of 93 mph

For the second successive year G. R. McGregor, president of the Kingston Flying Club, won the John Webster Trophy which is awarded annually to the foremost amateur pilot in Canada. C. E. Lloyd of the Toronto Flying Club, carried off second honors, and as runner-up won the City of Kingston Trophy. Flight-Lieut. R. H. Foss was third. The competition was held under the supervision of the Department of Civil Aviation.

Construction of three Northrop Delta transport and photographic planes being built by Canadian Vickers, Ltd., for the Department of National Defense, is nearing completion. These transports have been specially designed for high speed photography, the cabin being cleared of the usual seating accommodations, and mountings for three oblique cameras provided within the fuselage. There is provision also for the taking of vertical photographs.

The plane carries 1,350 lbs. of photographic equipment, and is fitted with floats, although the conventional land gear or newly developed skis can be substituted.

As the aircraft will operate almost exclusively in Northern Canada, a large door has been provided in one side aft of the wing to allow loading of large equipment.

France

As of January 1, 1936, there were 2,197 civil aircraft registered in France, its colonies and its mandated areas. These comprised 2,122 land planes, 66 seaplanes, and 9 amphibians. Total number of aircraft registered in France only was 2,093 of which 712 were privately owned, 398 by clubs, and 154 by air transport companies.

A new light 2-place airplane known as the *Volland* was recently tested at the St. Cyr airport. Of wood construction, the plane is an unequal span biplane equipped with a 60 hp (at 2500 rpm) Regnier 2-cylinder, air-cooled engine. Specifications indicate a wing span of 23 ft.; overall length of 19.7 ft.; overall height of 6.5 ft.; wing area 129 sq. ft.; empty weight 606 lbs.; useful load 562 lbs.; gross weight 1168 lbs. Maximum speed is 106 mph; landing speed 37 mph; range 621 miles; and ceiling 13,776 ft.

Germany

Approval has been given to a bill providing for construction and operation of an airport for Luxemburg City and the Grand Duchy of Luxemburg. Bill provides for a $425,531 bond issue of which not more than $148,936 may be expended during 1936. Bill further provides that complete regulations for aerial navigation in the Grand Duchy as well as police and customs regulations be prepared at the earliest possible moment.

Great Britain

Total number of civil aircraft registered in Great Britain increased from 1,209 on March 31, 1935, to 1,577 on December 31, 1935. Number of planes operating transport routes increased from 128 to 168. Substantial increases are expected this year and it is believed that planes of American design, manufactured in Great Britain, will make an interesting showing.

Of planes registered at the end of 1935, 11 percent were owned by air transport companies, Imperial Airways, the largest company, had 43, followed by British Airways, Ltd.

London and Budapest were connected with direct service when Imperial Airways started operations on its longest and fastest service (daily) in Europe. Stops are made at Cologne and Vienna. In survey flights over the 1000-mile route the trip was completed in about 6 hours, although scheduled time for the run is 7 hours 45 minutes.

Highland Airways (Inverness, Scotland) is operating the first scheduled air service connecting Aberdeen and the Shetlands. Regular service to the Shetlands was previously impossible because of lack of radio communication facilities for navigation. The Shetlands, previously ten or twelve hours from the Orkneys by steamer, can now be reached by plane in forty minutes.

Short Bros., and Harland & Wolff (Belfast), ship-building firm, are forming a new company for constructing aircraft of both land and marine types at Belfast. According to reports, the new company will have an authorized capital equivalent to about $2,250,000, Short Bros. controlling 60 percent of the common shares and the balance by Harland & Wolff.

Scheduled service between the Irish Free State and England is now offered by Blackpool & West Coast Air Services between Liverpool and Dublin. An intermediate stop is made at the Isle of Man.

One more example of **PORTERFIELD** *supremacy*

AT THE 1936 National Air Races at Los Angeles, the Porterfield 70 with LeBlond 70 horsepower engine was the only airplane under 100 hp. able to qualify for the necessary 100 m.p.h. on the official five-mile triangular course for the Amelia Earhart Trophy Race. Others with between 70 and 100 hp. made the attempt and failed to qualify. No other make of airplane selling for less than twice our price could qualify to enter.

It was officially announced that Miss Edna Gardner completed her last lap at 112 m.p.h. on the five-mile triangular course. The plane used was a standard model in daily student use and had flown over 800 hours.

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CLASSIFIED ADVERTISING LEADERSHIP

IN the six months from April to September of this year AERO DIGEST published 1,562 classified advertisements—as against 371 for the second aeronautical magazine.

The September AERO DIGEST, alone, carried 288 individual undisplayed classified ads, as against 43 for Magazine Number Two.

The answer to this wide margin of leadership is *volume* circulation of the *buying kind.* When you have something to sell—or wish to buy—think of AERO DIGEST first.

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ITALIAN MILITARY PLANES

(*Continued from page* 40)

folding wings are mixed construction with wooden spars and ribs and metal bracing and are fabric-covered. Trailing edge flaps operate manually simultaneously with the leading edge slots which extend along the entire span of the wing. Fuselage is of welded steel tube covered with fabric. Bendix brakes, Eclipse starter, controllable-pitch propeller and automatic fire extinguishing apparatus are standard equipment. Equipped with a 140 hp Colombo 6-cylinder in-line air-cooled engine a maximum speed of 140 mph is obtained. Landing speed is 40 mph, range 560 miles, and service ceiling 19,700 ft. Empty weight is 1235 lbs.

Seaplane Fighters and Light Observation Types

The C.M.A.S.A. MF 6, a 2-seat fighter and reconnaissance all-metal flying boat is designed for catapulting. Constructional details are not available but performance figures as released by the Italian Air Ministry show a top speed of 161 mph when equipped with a *Jupiter VI* radial air-cooled engine. Landing speed is 57 mph, climb to 16,400 ft. requires 26 minutes, and range is 745 miles. Empty the M.F. 6 weighs 3014 lbs.

The Cant 25 A.R. is a single-seat fighter flying boat of unequal span, rigidly braced biplane design. The hull, designed for catapulting, is of the single step type built up of a series of 5-ply ash and spruce formers, covered with plywood. Wing structure consists of spruce spars, dural ribs, and fabric covering. Equipped with a Fiat A-20 water-cooled engine of 400 hp mounted between the wings and driving a pusher propeller, top speed is 152 mph. Absolute ceiling is 20,336 ft. and range at cruising speed is 560 miles. Fully loaded the 25 A.R. weighs 3753 lbs. and climbs to 16,400 ft. in 26.5 minutes. Armament consists of 2 fixed guns placed in the hull and firing forward.

A new experimental sea fighter is the Romeo Ro. 43, a single-float single seat type of design similar to that of the Ro. 41, a two-place landplane fighter. Equipped with a 700 hp Piaggio *Stella IX RC* engine in an NACA type cowling, maximum speed is about 215 mph.

The Piaggio P-10 is a standard 3-seat reconnaissance seaplane designed for catapulting. The folding wings are unstaggered, of equal span, and are supported by a system of steel W-type interplane struts. Fuselage is of oval section and wooden monocoque construction tapering to a vertical knife edge aft. A long single-step wooden float is attached to the fuselage by two pairs of cross braced streamlined steel-tube struts. Three cockpits are located in the fuselage, the pilot being forward of the wings and the observer aft near the tail. The gunner's cockpit, equipped with a Scarff mounted machine gun, is directly aft of the wings and forward of the observer who has an unusually wide field of vision due to his position and to the narrow sloping fuselage. The 450 hp Piaggio *Jupiter* radial gives a top speed of 160 mph at 10,000 ft.

(*To be continued in November*)

ASPHALT SURFACES

(*Continued from page* 32)

ing particularly well adapted to locations where the operation of a heavy roller is difficult.

While generally, construction procedure on airports is similar to highways, there are locations where, due either to sand or swamps, the use of rollers is not practicable for initial rolling. In such cases the stabilization work on the subgrade and the first compaction of the bas course can be best accomplished b crawler tractors. This will be sufficient t build up a support so that rollers may b used on the final consolidation of the bas course and for the entire compaction o the wearing course.

The building of runways is best accomplished as a number of longitudina lanes. A 20-ft. lane is a good width wher application of asphalt is made by distributor; 20 or 30 ft. width where plant-mixe are to be spread and finished by mechanical means. The difficulty formerly experienced in operating trucks and distributor over soft soils may be eliminated b using special pneumatic tires. For mixed in-place surfaces, special disc harrov equipment has been developed which permits quick turning by lifting the disk completely off the ground, thus avoidin churning. In practically all other respects airport surface construction is similar t highway construction procedure.

FOLKERTS SPECIAL

(*Continued from page* 64)

lay under the pilot's knees. When droppe for a landing, which is also done positively through the cable operating system the pilot can see that the wheels are dow and the safety catch in place. If necessary, he can push the gear with his feet to assist in getting it down.

Specifications and performance figure of the Folkerts Special with the 185 h Menasco are as follows:

Wing span	16 fee
Wing area	50 square fee
Overall length	19 feet 6 inche
Weight empty	675 pound
Useful load	325 pound
Gross weight	1000 pounds
Maximum speed (sea level)	240 m.p.h
Landing speed (flaps down)	67 m.p.h

Trade Literature

Stainless Tubing

Adaptability of stainless steel tubing to a multiplicity of applications is indicated in the newest Carpenter Steel Co. catalog which provides helpful data on the properties and use of this type of welded tubing.

Information is supplied in ready reference form, supplemented by various facts on the properties of stainless alloys, applications for stainless tubing and notes on corrosion.

Hand Tools

Known as Catalog #36, Bonney Forge and Tool Works, Allentown, Pa., has issued a 56-page book showing a complete and expanded line of hand tools.

The book illustrates and describes a full line of sockets with handles and attachments in 9/32", ⅜", ½", ¾" and 1" square drives, extra-deep sockets, drain plug squares, special sockets and the following wrenches: solid socket, engineers and tappet, ignition and electrical, *TuType,* right-angle, water pump, angle head service, construction and structural, *S,* set screw and brake, as well as miscellaneous tools including holding tools, tweezers and a handy shop knife.

Floor Trucks

A new, fully illustrated circular, No. 220, on easy-rolling floor trucks for factory and warehouse, used extensively by manufacturers, warehouses and distributors for interior movement of every type of product, merchandise, or goods, has been issued by Lewis-Shepard Co., Watertown, Mass. Several new types of caster, rubber-tired, and shelf trucks are shown.

Brushes

Forty-eight pages of descriptions and illustrations of paint brushes, artist and sign writers' brushes, and industrial brushes of every type, are now available in Catalog #36, published by David Linzer & Sons, Inc., New York City. Many improvements in brush construction are shown including all grades of Pre-Treated brushes, which are broken-in for immediate use.

Electric Tools

Independent Pneumatic Tool Co., Chicago, issued *High Frequency Electric Tool Catalog* 60, which contains a complete showing of attachments for electric screw driving and nut setting. Included are illustrations and specifications of the *Thor* line of hig frequency electric tools, includin drills, drill stands, screw drivers nut setters, tappers and stud setters, grinders, sanders, rubbers polishers and balancers. There i also a section on universal electri tools, pneumatic tools and contractors' tools.

Parts

Catalog No. 10 has been issue by Air-Parts, Inc., Glendale Calif., to bring its line of aircraf and engine parts up to date.

In this book, they have include a table of fits and clearances fo modern aircraft engines accordin to manufacturers' specifications Also incorporated is a complet itemized list of various aircraf ball and roller bearing sizes. A further information there is liste with each engine, the micromete dimensions of numerous part regarding standard sizes.

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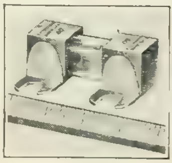

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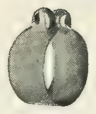

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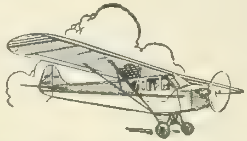

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1 Wright Whirlwind R-975E; 330 h.p.
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2 Wright Whirlwind R-975D; 330 h.p.
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1 Continental A-70; 165 h.p.
Total time 100 hours; engine just top overhauled. Complete with exhaust manifold. Price....$650

1 Wright Cyclone R-1820E.
This engine has had very little time, but is in need of a major overhaul. Price, as is, $750. We believe that this engine can be overhauled and reconditioned for a cost of approximately $300.

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WACO Cabin, 1933: 210 Continental; excellent condition, motor majored; landing lights, flares.

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FOR SALE: C-3 Aeronca, excellent condition. Licensed. New tires and propeller. Winter enclosure. Recently recovered and majored. A bargain. $795. H. M. Dunsworth, Municipal Airport, Hutchinson, Kansas.

AERONCAS: Used, latest models, high and low wing. Also new Aeroncas. Prices upon request. United Aero Corporation, P. O. Box 222, San Antonio, Texas.

'34 AERONCA: Licensed August '37. Perfect condition: heater, enclosure, compass; $975. Paul E. Long, Frankford, Delaware.

NEW LOW WING Aeronca: 85 LeBlond, air brakes. Latest type. In first class condition, like new. 70 hours total. Price, $2 500. Bob Duckworth, Bowman Field, Louisville, Kentucky.

FOR SALE: AERONCA C-3: Motor E-113-A. Total time, 185 hours. Equipped with winter enclosure, cabin heater, airspeed, compass. thermocouple, brakes, navigation lights, streamline tires. latest type landing gear and stick. Ship licensed until July, 1937; perfect condition. Price, $925. Fred Ramhorst, 20 Jelin Street, New Brunswick, New Jersey.

AERONCA C-2: Just relicensed. Wings and fuselage refinished. Motor top overhauled. New prop and tires. Scintilla magneto. $375 cash. Harold Little, 786 Virginia Circle, Atlanta, Georgia.

1935 AERONCA C-3: Converted E-113-C engine at factory, 40 hours back; $200 extras. including streamlined wheels and brakes; perfect throughout; $1 095. Carl Weber, Municipal Airport, Evansville, Indiana.

AERONCA C-3 Master Cabin: New May, 1935; motor 113-C; compass, heater, extra gas tank; condition like new. Total hours 130. $1,175. Orval Denlinger, 140 Warren Street, Dayton, Ohio.

AERONCA LOW WING: Incorporating late factory changes. Powered latest 85 horsepower LeBlond. Flown only 40 hours by business executive who needs larger ship. New plane guarantee. $2,400 cash or terms. Save over $750. Tabs, air brakes, wheel brakes, air speed, compass, Waltham clock, cabin ventilator. If you want it, act fast! AERO DIGEST, Box 2419.

AERONCA C-3: Late type, $700. This plane is in beautiful condition. It has a winter enclosure, heater, etc. Terms. Pioneer Aviation Company, Airport, Syracuse, New York.

AERONCA LOW WING: LeBlond 70; less than 100 hours total time. Equipped with flap. Write or wire Salzman Aircraft, City Airport, Detroit, Michigan.

AERONCA MASTER C-3: Late 1935 model, slightly used; under 100 hours. Must be sold this month. Any reasonable offer considered. Dan Wallace, Santa Barbara, California.

LOW WING DEMONSTRATOR: Perfect condition, like new; standard paint job; flap. $2,000. Trades considered. AERO DIGEST, Box 2428.

LE BLOND 70 low wing, 275 hours, perfect, $2,000. 1936 C-3, 260 hours, perfect, $1,200. 1935 C-3, engine factory majored 35 hours back, $1 000. English Avian, good condition. $500. English Cirrus; used, $60; new, $250. Tred Avon Flying Service, Easton, Md.

'36 AERONCA MASTER: Like new, 40 hours, $1,350. Also late '34 Aeronca; heater, enclosure, wonderful shape; just relicensed, $8 0. Finance and trade. "Al" Leeward, New Kensington, Pennsylvania.

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AEROMARINE KLEMM: LeBlond "60"; 30 hours since major; licensed August '37; brakes, airwheels; never cracked, excellent condition; $500. W. R. Franke, 222 Jefferson Park Avenue, University, Virginia.

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SALE OR TRADE: Air King OX-5, 3-place; dual controls. 8 hours since major overhaul. Good flying condition. Licenseable; sacrifice $200. Everett Litten, Woodhull, Illinois.

Alexander

ALEXANDER FLYABOUT: 2-place cabin monoplane, with late model 45 Szekely motor, just majored. Complete instruments. $475 or trade for open light plane. Also, late model Szekely 45 motor, $150; new top assembly. Hensler, c/o Garage, 429 East 75th St., New York, N. Y.

American Eagle

OX-5 AMERICAN EAGLE: DH wheels, compass, dual controls; two wings need rebuilding; sacrifice, $150; or trade. George Warner, 16th and Meeker, Muncie, Indiana.

AMERICAN EAGLE: Model 101, OX-5. Recovered 15 months ago. A-1 condition. Will accept any reasonable offer. Fritz Van Briesen, Sheldon, Iowa.

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ARGO BIPLANE: Excellent condition. Airwheels, turn and bank, pitch, airspeed, Hamilton steel propeller just overhauled by factory. Licensed July 15, 1937. $850. Will consider trade on three- or four-place ship. K. F. Stuhldreher, 46 Erie Street, Massillon, Ohio.

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ARROW SPORT: Kinner K-5. Licensed August '37. 800 hours. New guides, springs and rings. Regular instruments. Hartzell prop. Trade or terms. 2618 Bent, Cheyenne, Wyoming.

ARROW SPORT: LeBlond 65. $300. Fuselage recovered June, 1936. No time on motor since top overhaul. Speed ring, air speed, altimeter, etc. Pete Brucia, Springfield, L. I., New York.

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FOR SALE: Two-place Cirrus Avro-Avian biplane. First class condition. Licensed to March 1937. $450. C. H. Fosdick, 946 W. Wilcox, Peoria, Illinois

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1932 B-5 4-PLACE Bird: Steel propeller, air starter, cowling for front cockpit, brakes, 8.50 x 10 tires; priced, $1,500. Muncie Aviation Corporation, Muncie, Indiana.

KINNER BIRD: Lights, brakes, semi-airwheels, duals, $850. Kinner Standard Trainer, just relicensed, $850. Trade both on Stinson S. R. Kerr, Patterson Heights Airport, Beaver Falls, Pennsylvania.

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BIRD: Kinner K-5, absolutely new condition; completely covered, new, bolts, windshields, airwheels, cables. Price, $1,175; can be financed. Dick Schall, Berwyn, Maryland. Also Kinner parts.

BIRD: 100 h.p. Kinner. 3-place. Just majored. Airwheels, duals, fuselage recovered, lights, beautiful all yellow finish. $1,250. Will trade and finance. "Al" Leeward, New Kensington, Pennsylvania.

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125 WARNER CESSNA: Licensed. Motor 8 hours since overhaul. Airwheels, tailwheel; new upholstery. Many extras. Ship A-1 condition. $895. Ben I. Glick, Blackwell, Oklahoma.

125 H.P. WARNER CESSNA: 4 PCLM; newly recovered; few hours since complete engine major. Semi-airwheels, brakes, nearly new Standard steel adjustable prop. New tail wheel. Inside cabin refinished and new upholstery. A-1 and good for years of dependable service. $1,175. Joe W. Hendrix, 109 B. Street, Hereford, Texas.

Buhl

BUHL PUP: Good condition throughout; 250 hours total time; licensed to January 1, 1937. Compass, airwheels, airspeed. Price, $385. W. F. Baggerman, 731 Radcliffe, University City, Missouri.

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BUHL PUP: Short wings, many extras; N C license. Reasonable. Berk-Ad Bureau, Great Barrington, Massachusetts.

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WARNER COMMAND-AIRE: Three-place, duals, steel propeller, motor just majored; plane just licensed for 1937. Price only $785. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

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2 TAYLOR CUBS: J-2, 1936; one month old; price, $1,250 each. One Taylor Cub J-2, 1936; four months old; price, $1,150. Planes are in A-1 condition; just like brand new. No trades; cash only. Further details furnished upon request. K. Schroeder, 200 Washington Street, Jamestown, New York.

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CURTISS JUNIOR: Motor just majored, plane recovered; just the plane for building time in. Terms only $150 down, balance easy. Pioneer Aviation, Airport, Syracuse, New York.

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CURTISS ROBIN OX-5: Licensed. Excellent condition throughout. Fully equipped with instruments. Must be seen to be appreciated. Price, $550. William B. Miller, Columbia, Louisiana.

OX-5 ROBIN: Unlicensed; Millerized, Scintilla magneto and steel propeller. $375 cash; not interested in payment plans. Ervin Boldt, 2562 Jones Street, Omaha, Nebraska.

OX-5 CURTISS ROBIN: Model B, licensed; Pioneer airspeed; clock, new tires, duals, good covering, oleo struts; one top overhaul on motor since new; new magneto, motor turns 1410 on ground. Worth more than price asked. $495. Consider trade. Fred Summers, Konawa, Oklahoma.

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OX ROBIN: Perfect condition. Recovered last year. Standard instruments. 30 x 5 wheels. Scintilla mag. Price, $485 or trade. L. Lightfoot, Route 1, Gary, Indiana.

CHALLENGER ROBIN: No time since new pistons and rings. Ship refinished, licensed until May, 1937. Duals, brakes, air speed, bank and turn, pants, speed rings and adjustable steel propeller. Price, $900. Will accept late model car on deal. Ernest Medkief, Hereford, Texas.

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CURTISS THRUSH: J6-7, 6-passenger cabin. Recently recovered; interior decorated; modern improvements; built-in wing landing lights, flares, etc. 85 hours since factory major overhaul; A-1 condition, licensed, never cracked up. Ideal passenger-hopping, cross-country, photographic ship. Sacrifice, $1,450 cash; no trades. Aero-Graphic Corporation, Bowman Field, Louisville, Kentucky.

Doyle

DOYLE: LeBlond 65. Two-place tandem monoplane. Dual controls. Licensed. 250 hours; good condition. Compass and airspeed. New propeller. Cruises around 90. $550 cash. Harry Troxell, Municipal Airport, Pontiac, Michigan.

Eaglerock

EAGLEROCK A-4 Hisso 180. Licensed until August, 1937. In good shape. Steel propeller, brakes and duals. $685. Stephen Petrovic, 150 Brahm Street, N.S., Pittsburgh, Pennsylvania.

EAGLEROCK: J6-5. 3-place. Dual instruments, dual control. Excellent condition, just overhauled; new woodwork in wings and center section. Recovered by Approved Station. Complete night equipment. Flares and Grimes new automatic retracting landing lights. Hamilton adjustable prop, Bendix brakes, red and silver. Privately owned. Consider late model car and cash. Priced to sell; $1 235. Ray Kuhl, c/o Stockert Hangar, Municipal Airport, South Bend, Indiana.

Fairchild

FAIRCHILD 24: 2-place cabin. Cirrus motor. Good condition, never scratched. Cabin; dual controls. Price $1,250. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

FAIRCHILD KR-34: J6-5; $1,350. Red wings, black and red fuselage; recently reconditioned; engine just majored and propeller etched. Always hangared, privately owned. Air wheels, late type oleo landing gear. Nice performing ship. Write or phone now. Joe Sythoff, Roosevelt Field, Mineola, N. Y. Garden City 3894.

J-5 FAIRCHILD FC-2: Hand inertia starter, standard instruments; motor just majored. Fin, rudder and one wing slightly damaged in wind storm. Will sell ship, motor or both. Best offer buys. Southern Airways of Danville, Inc., Box 205, Danville, Virginia.

FAIRCHILD KR-34: J6-5 motor; 60 hours since factory major. Hamilton steel prop, speed ring, tail wheel, complete instruments. Ship recovered new, May, 1936; painted cream, red trim. $1,500. Jeter Cox, Concord, North Carolina.

FAIRCHILD KR-21: Taper wings, front exhaust Kinner, completely recovered, special hand-rubbed finish, excellent condition and performance; $1,050. Willis Strong, Wold-Chamberlain Field, Minneapolis, Minnesota.

Fairchild

CHALLENGER KR-31: OXX-6 motor. Licensed May 15, 1937; good condition, real performer; $375 cash. James Wieberg, 1528 Caton Avenue, Elmira, New York.

FAIRCHILD 24: Inverted Cirrus motor. 405 hours total. Like new. Licensed October, 1937. Price, $1,700. Will take trade and time payments. AERO DIGEST, Box 2420.

FAIRCHILD 24: Cirrus powered. Built 1932. Licensed March 15, 1937. Hand-rubbed finish with blue fuselage and cream wings. 65 hours since major on engine. Equipped turn and bank and rate of climb. $1,585. $750 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

FAIRCHILD 24: Late 1935 model, with flaps, radio, turn and bank, rate of climb, other extras; time under 100 hours. Practically new airplane at lowest price ever advertised. Must be sold this month. Dan Wallace, Santa Barbara, California.

FAIRCHILD 24: 1936 Warner-powered demonstrator; 75 hours total time. Substantial discount. Weddell & Smith, Fairchild Distributors, City Airport, Detroit, Michigan.

FAIRCHILD 24: Warner powered. 147 hours guaranteed total time. 10 months old. Only one owner. Rate of climb, turn and bank, starter and flaps. Beautiful white paint job. $3,750. Will finance or take trade. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

FOR SALE: Ranger Fairchild 24. Good as new. Flown only 174 hours. Blue fuselage with yellow wings and trim. Equipped with radio, landing lights and radio shielding. Price $4,000 at duPont Airport, Wilmington, Delaware.

FAIRCHILD OXX-6 KR-31: Excellent condition. Licensed until August, 1937. Not restricted. $450. OXX-6 cylinders, $3. OX-5 motor, majored, $35. Cloyd Sayler, Somerset, Pennsylvania.

FAIRCHILD KR-34: J6-5 engine, rate of climb, bank and turn, semi-airwheels, brakes, tail wheel, completely recovered last year. $1,250. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

Fleet

WARNER FLEET: Privately owned; steel propeller, air wheels, dual control; never cracked up. Licensed to December. Total time, 475 hours. Price, $1,600. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

Fokker

FOKKER AMPHIBION: 575 h.p. Hornet, less than 100 hours since major. Licensed until September 1937. Weddell & Smith, Fairchild Distributors, City Airport, Detroit, Michigan.

Franklin

FRANKLIN SPORT: Velie 65; 700 hours; very good condition. $750. Neil R. McCray, Fairview, Pa.

Great Lakes

GREAT LAKES: Inverted Type B, serial 238; 420 hours; Hamilton adjustable, pants, brakes, lights, dual instruments plus bank turn, compass, air speed. Rubbed finish, practically new. $1,550. Deliver. H. Feilbach, 5378 N. 36th St., Milwaukee, Wisconsin.

GREAT LAKES: Completely recovered; high gloss finish. Never cracked. Motor majored. 10 hours since motor major and recovering by airline mechanics. Perfect condition. $1,050. Consider trades. Gary Airport, Gary, Indiana.

GREAT LAKES: 2T1A. Licensed June, 1937. Good condition. Air wheels, compass, air speed. $875. Vic Somogy, 1009 Second Street, Lorain, Ohio.

GREAT LAKES: Cirrus Mark III; engine majored; steel prop; just relicensed with pants and spare engine. Snappy looking. $985. J. A. Simcock, Front St. & Roosevelt Blvd., Philadelphia, Pennsylvania.

Inland Sport

INLAND SPORT: LeBlond 70 h.p. 2-place monoplane, side-by-side. Licensed, just overhauled; excellent condition. A good trainer. Price, $785. A. E. Hultzen, 843 N. Pine Avenue, Chicago, Illinois.

Kellett

KELLETT GIRO: Kinner C-5, 210. Blades, fuselage just recovered. Complete ship perfect condition, beautiful appearance. Ideal for banner towing or private flying. Brickert Oil Company, Farmville, Virginia.

KELLETT K2A AUTOGIRO: Continental 210 h.p. Less than 150 hours on engine; 450 hours on ship. Side-by-side seating. Completely overhauled. Privately owned. Closed cabin. Licensed. Good for advertising and dusting. Steel propeller. Hangared. $1,800 cash. AERO DIGEST, Box 2421.

Laird

LAIRD, WRIGHT 330: Only 247 hours time since new. Only one owner. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. The most beautiful sport plane in America. $3,250. Will finance or take trade. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

Lambert

MONOCOUPE: Series "40" Warner Scarab enclosed valve motor, never touched except regular checks and not needing overhaul now. Complete ship and equipment in finest condition. All flight instruments. Licensed September 1937. Beautiful cross-country job for pilot enjoying performance. $1,850—not a dime less. Demonstrate anywhere for expenses. F. R. Smith, Clinton, Connecticut.

LAMBERT MONOCOUPE: Delivered May 1933. Racing landing gear, pants, steel prop, collector ring; 6 hours since major on engine. Salzman Aircraft, City Airport, Detroit, Michigan.

VELIE MONOCOUPE: Perfect condition, air speed, bank indicator, hand-rubbed finish. An exceptional buy at $450. V. E. Millard, 824 Belmont, Chicago, Illinois.

LAMBERT MONOCOUPE: Engine complete major overhaul, recovered and finished in high lustre, entire ship; special engine ring and pants; special leather upholstering; left door installed; tail wheel. Price, $2,200; will consider trade; can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

Loening

LOENING COMMUTER with J6-9 Wright 330 h.p. Excellent condition. $3,250. Trade for good 4- or 5-place cabin plane. Northern Air Service, Berlin, New Hampshire.

LOENING COMMUTER amphibion: Wright J6-9-D. Less 300 hours. Motor top overhauled. No salt water. Color blue and silver. Beautiful condition. Licensed August '37. $3,000. Douglas Burton, Lake George, New York.

Moth

DH MOTH: Licensed until November 1936. Airwheels, compass, duals. Always privately owned. Only 250 hours on ship. Will sell for cash only. Write Charles Foy, Clinton, Iowa.

DH GIPSY MOTH: Licensed. Ship and engine new shape; all instruments, air wheels, also two excellent parachutes. No trades. Box 101, Winslow, Arizona.

GIPSY MOTH: Just recovered. 100 hours since major on engine. Cleanest Moth in country. $745. $350 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

N-B Trainer

N-B 8, GENET: Licensed, good condition; speed ring, extra prop, oleos, air wheels, $550 or trade for good cabin plane. D. E. MacCollum, 234 S. Winter, Adrian, Michigan.

GENET BARLING NB-3: Recovered. New prop. Less than 50 hours since major overhaul ship and motor. Licensed July, 1937. $850. Will finance. OX-5 Eaglerock, licensed June, 1937. $295. Arthur Smith, 1453 Barnesdale Street, Pittsburgh, Pennsylvania.

BARLING NB-3: Powered Genet engine. Engine just majored, airplane completely recovered and reupholstered. Licensed to May, 1937. $795. $397.50 down. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

Northrop

NORTHROP DELTA: 8-place; Wright Cyclone F-3, 715 h.p. Excellent condition; used only 200 hours; will guarantee 200 m.p.h. cruising at altitude. 328 gal. gas; 1500 mile range. Fully equipped. Cost $38,000. For information, write Ed. Nirmaier, Sharonville, Ohio.

Pilgrim

PILGRIM KR-21: Kinner powered, brakes, fully equipped; only $885. See this snappy airplane. Terms; for preference wire Pioneer Aviation Company, Airport, Syracuse, New York.

Pitcairn

PITCAIRN AUTOGIRO: 3-place Wright E, 330 h.p. Good condition; quick sale, $1,500. Newman Bros. Flying Service, Pine Brook, New Jersey.

Porterfield

PORTERFIELD: Only 48 hours guaranteed total time. New March 15, 1936. Brakes, navigation lights, upholstered, duals, shielded for radio. A practically new ship at a substantial discount. $1,585. Will finance or take trade. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

1936 PORTERFIELD LeBlond 70 demonstrator; dual controls, dual brakes, speed ring, etc. Very little time, reasonably priced. Bush, 5214 W. 63rd Street, Chicago, Illinois.

Rearwin

REARWIN SPORTSTER: 1936 model. 4 months old. Speed ring, brakes, airspeed, compass; never cracked. 125 actual hours. $2,000. Ringel Flying Service, 917 Bigelow, Peoria, Illinois.

REARWIN SPORTSTER: 10 months old. Guaranteed perfect. $1,685. Will finance or take trade. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

REARWIN, MODEL 7000: Demonstrator, less than 100 hours. Extras include airwheels and brakes, speed ring, ventilators, carburetor heater, compass, air speed and bank indicator. Cost $2,712.50. Seven months old; excellent condition. Will sacrifice for $1,950. The H. C. Robbins Company, Rearwin Distributors, Cleveland Airport, Cleveland, Ohio.

1936 REARWIN SPORTSTER: LeBlond 85; just delivered, only 70 hours total; I paid $2,868 this July, will sell for $2,100; brakes, compass, air speed, tail wheel, speed ring; Norman Warren, Holmes Airport, Queens, New York.

Ryan

J-5 RYAN B-1: Just relicensed; excellent condition. Total time, 800 hours. Price, $1,000. Kenneth Garrett, Pine Bluff, Arkansas.

RYAN B-3: J6-9 Wright motor (now being majored). Covering now less than one year old. New tires. Ship in perfect condition. Six-place. Licensed for five. This motor is worth more than we are asking for the outfit, $1,495. E. C. Bearden, 24 East High Street, Lawrenceburg, Indiana.

J-5 RYAN: Just overhauled, relicensed. A money maker. Meriwether Aircraft, Manchester, Georgia.

Savoia-Marchetti

MOST BEAUTIFUL DUCK on water. Savoia-Marchetti amphibion, 3-place; B-5 Kinner powered. Ship has 300 hours, motor 200 hours. Heywood air starter, air wheels; 20 hours since ship was completely rebuilt and recovered by Skyways, Inc., Cleveland, Ohio. New bottom, sides, keel and bulkheads. Many chrome-plated parts from de luxe job. No oil, gas or water leaks. International orange wings, stabilizer and elevators. Top of hull Stinson green, sides silver. Trimmed in silver and orange. Ideal for Southern flying and fishing trips. Price, $2,000. Licensed up to August, 1936. Roy Williams, 2816 E. Market Street, Warren, Ohio.

Swallow

SWALLOW: 3-place, identified; OXX-6, 28 hours since new. Scintilla mags, one new. Covering A-1. Always hangared, log books. Ship overhauled and covered by Approved Station. Will sell or trade for lighter plane. J. J. Kirby, Smith's Grove, Kentucky.

SWALLOW HC: Licensed to May, 1937. Continental 165. Hamilton steel propeller, exhaust ring, air wheels, brakes, Heywood starter; total time 440; 75 since top overhaul. $1,500. Will trade for Rearwin Sportster, low wing Aeronca or Monocoupe. Jack Phillips, Box 1891, Dallas, Texas.

SWALLOW: Millerized OX-5; turns 1475. New Fahlin prop. Licensed to September 1937. In excellent condition. Sell or trade; cash price, $350. Al Sielaff, Alden, Iowa.

Spartan

SPARTAN J6-5: Licensed, 3POLB, excellent condition. 5 hours since top overhaul. New tires, oleos, brakes, compass, airspeed, bank and turn, lights, dual controls, metal prop. 65-gallon gas tanks. Color blue and orange. $1,150. Location Peoria, Illinois. Deliver for expenses. Joe Mason, Farmington, Ill.

CHALLENGER SPARTAN: 3 POLB. Just factory reconditioned and recovered. New J6-7 landing gear, Warner semi-airwheels and brakes with 8.50 x 10 tires. Airplane total time, 412 hours. Engine, 16 hours. Spare engine, 396 hours. Licensed to July '38. Price, $1,825. Jess Green, Spartan Aircraft, Tulsa, Oklahoma.

Simplex

SIMPLEX RED ARROW: Model K-2-S, midwing. New dope. Kinner K-5; good condition, just majored. P. J. Hector, 741 Locust Street, Owensboro, Kentucky.

CLASSIFIED ADVERTISING FORMS for NOVEMBER

Will close Monday, October nineteenth. Copy arriving after that date will be held over for the December issue, unless instructions to the contrary are provided.

Please mail your copy and remittance on time—to avoid missing the issue

Stinson

1935 SR-6 STINSON RELIANT: NC15116. Standard instruments plus Kollsman sensitive altimeter. Smith controllable propeller. Finish, cream and red. 100 hours total time, $5,500. Sioux Skyways, Sioux Falls, South Dakota.

STINSON: Warner 125, steel propeller; excellent condition; will sell cheap for quick sale. Now hangared at airport, Marion, Ohio. Floyd E. Schaffner, Delaware, Ohio.

STINSON RELIANT: 1933 model. 72-gallon gas, turn and bank, rate of climb, Kollsman sensitive altimeter, complete radio shielding; 513 hours total, 60 hours since major overhaul personally supervised by owner. Motor runs clean and smooth. This airplane has been maintained without regard for cost and is a real bargain at $2,800. E. F. Dutro, Zanesville, Ohio.

STINSON RELIANT: De luxe, 1933. Special paint job, leather upholstery. Radio, night flying equipment. NACA cowling and fully streamlined. Price, $3,000. Bob Duckworth, Bowman Field, Louisville, Kentucky.

STINSON R: High gloss finish, leather upholstery, wonderful appearance and performance. Perfect condition throughout. Motor just majored. Privately owned. Absolutely must sell immediately. Price $1,750, flyaway. A. K. Miller, Willard Place, Montcair, New Jersey.

WARNER STINSON: Fuselage recovered, motor majored, prop etched, new tires; refinished in red and cream and cabin re-upholstered. $800, flyaway. R. W. Merrifield, Box 525, Aberdeen, South Dakota.

STINSON RELIANT SR-6: Five-place; extra equipment includes Smith controllable prop, R C A radio, landing lights, 75 gallon tanks, flares, turn and bank, rate of climb, generator, leather upholstery and special red and white finish. Purchased new from Stinson June this year. Has 150 hours and in perfect condition. $5,850. Walter Taber, Municipal Airport, Kansas City, Missouri.

STINSON 1934 SR: Lycoming. Turn and bank, rate of climb. Color brown with orange stripe. Cushions green leather. Total time, 350 hours. Privately owned. $4,300; accept $2,500 down and balance monthly. Never cracked. Wired deposit advised. Radio beacon and other band receiver. Aviation Finance Co., Hemlock, New York.

TRIMOTOR STINSON T Airliner; 20 hours since complete major and modernization on motors. Licensed August, 1937. Night equipment, starters, all instruments, spare airwheels, hubs, tailwheel. A-1 shape. Will trade and finance. $2,650. Wire "Al" Leeward, New Kensington, Pennsylvania.

STINSON SM8A: Licensed to May, 1937. High lustre finish, red and yellow. Steel propeller, generator and starter. $1,595. Will finance or take trade. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

STINSON S: Lycoming powered; fully equipped; real buy at $1,800. Stinson, Wasp powered, $2,600. Warner Stinson, $800. Terms. Pioneer Aviation Company, Airport, Syracuse, New York.

STINSON: Wasp C-1. 7-place. Excellent condition. License expires June '37. Motor top overhauled. Excellent photographic plane. Exporters take notice. Light sedan accepted on deal. Priced right for cash. W. Blain, Grand Rapids, Michigan.

PERFECT STINSON SR-5B: 254 hours total. Carefully handled, maintained by one pilot only, private use only. 107 hours since Lycoming factory top. Never scratched. Equipment: controllable prop, 75-gallon tanks, lights, flare, radio, bank, turn, rate climb. 245 h.p. Oil, less than 1 pint per hour. Cost nearly $8,000. Sell, $4,950. Address AERO DIGEST, Box 2429.

STINSON MODEL R: Very little time since overhaul. Fully equipped. Appearance like new. Trades considered. $2,300. W. L. Burall, 3311 Liberty Heights Avenue, Baltimore, Maryland.

1934 STINSON RELIANT SR-5: De luxe finish and upholstery; complete equipment, including Smith propeller, large tanks, gyro, horizon, bank and turn, rate of climb, sensitive altimeter, Daiber compass, radio, etc. Also flares, landing lights and generator. 175 hours flying time; excellent condition; ship used for personal travel only. S. H. Smith, 3108 West 121 Street, Cleveland, Ohio.

STINSON: J-5, 6-place. Just recovered, completely overhauled, very attractive; finished International orange, trimmed blue; tail wheel. Sell or trade on New Standard. Indiana Air Service, Airport, South Bend, Indiana.

STINSON MODEL W: Wasp Jr., just topped; ship and motor in excellent condition throughout. Electric inertia starter, bank and turn, rate of climb, clock, thermocouple; both gravity and fuel pressure systems; fenders. Price, $2,250. White Flying Service, Caldwell Airport, Caldwell, New Jersey. Caldwell 6-1560.

STINSON SM8A: Lycoming; ship and motor perfect. Motor 35 hours since major. Landing lights, night flying instruments, electric starter. Total 825 hours. $1,700. Norm Peters, Stickney Avenue Airport, Toledo, Ohio.

Travel Air

GIPSY TRAVEL AIR: Fabric excellent; blue and orange; 3 hours since top; 400 hours total; brakes both cockpits; tail wheel; $1,000. R. W. Pyper, Pittsburgh-Butler Airport, Butler, Pennsylvania.

J-5 TRAVEL AIR 4000: 20 hours since major and recover by Approved Repair Station. Ship perfect; $1,250. H. H. Bender, 4429 Westway, Toledo, Ohio.

TRAVEL AIR 2000: Millerized OXX-6. Excellent condition. Licensed till September 2, 1937. New propeller, many extras. Extra magneto, propeller. Will trade for '36 car. Billie Carpenter, Hugoton, Kansas.

TRAVEL AIR: 2-place sport trainer; Warner motor. Ship and motor just completely overhauled throughout A real buy at $1,250. Photos sent on request. Bill Farly, Albany Airport, Albany, N. Y.

J-5 TRAVEL AIR: Model B-4000. Late outrigger type landing gear, with large airwheels; good set of instruments; metal cover for front cockpit; licensed to April 1937. Price, $900. Will fly anywhere for expenses. Kermit R. Hatt, Milo, Maine.

6000-B TRAVEL AIR: Modernized J6-9. Recently recovered and relicensed. Never cracked. 100 hours on engine since complete major. A real buy for $2 250. Would consider light ships on trade. Ellis Eno, Fort Dodge, Iowa.

HISSO TRAVEL AIR 3000: Just refinished; steel propeller, brakes, motor new. Licensed for another year; in perfect shape. Price, $800. Will accept car in trade. R. R. Roberts, Box 208, Gladewater, Texas.

TRAVEL AIR 6000-B: Monoplane. Six-place. Just relicensed. Ship and motor in perfect condition. Equipped for night flying. Take $1,350. C. W. Peffer, 7604 S. Halsted, Chicago, Illinois.

6000-B DE LUXE Travel Air: 7-place, 330 h.p. Electric starter, generator, lights, flares, air wheels, Sperry; cover 1 year old. Major 225 hours. Price $2,250 or trade for smaller ship. C. W. Siehl, Sherburn, Minnesota.

Verville

VERVILLE J6-7 Air Coach: Starter, generator; 125 hours since major. Ship A-1 condition; $1,250. H. H. Bender, 4429 Westway, Toledo, Ohio.

J6-7 VERVILLE: 4PCLM. A-1 shape. Starter, retractable lights. Service ceiling, 18,000 feet. Outperforms Stinsons. $1,395. Extra J6-7, majored, $450. Airwheels. M. Buck, 2941 Union Street, Madison, Wisconsin.

Waco

WARNER WACO F: Newly majored and covered. In perfect shape. $1,450. Witch Duck Aeroplane Corporation, 250 Bank Street, Norfolk, Virginia.

1933 WACO C: Engine 35 hours since factory major and modernization; new tires, new leather upholstery. Ship in first class condition; license expires July 1, 1937. Aeronca engine, propeller and wheels, in good condition; price reasonable. Arthur E. Lamparter, Lancaster Airport, Lancaster, Penna.

1933 WACO CABIN: Continental motor, 210 h.p.; starter, all blind flying instruments, flares, landing lights, steel propeller; relicensed to August 1937. Total time 360 hours. Price, $3,000. C. Descomb, Crystal Drive, Wethersfield, Connecticut.

WACO C 165: Just recovered, new upholstery, motor majored, total time 350 hours. A clean ship for any purpose; cash or part trade. Midwestern Aviation Corporation, Seymour, Indiana.

WACO C: Continental 210, majored and modernized by Continental factory. Heywood starter, landing and navigation lights, radio receiver. Licensed until August 1937. $2,350 cash. Paul Cox Airport, Terre Haute, Indiana.

WACO CABIN, 1934: With completely modernized Continental engine. Total time 217 hours. Equipped with radio, lights, flares, strut fairing, seat covers, and extra instruments. Color, green and cream. Ship in excellent shape and ready to go. Wings Field, Inc., Ambler, Pennsylvania.

WACO GXE: OX-5; completely recovered year ago. New prop, licensed, Millerized, ship hangared. Less than 250 hours on motor. $475. Lehman Pinckney, Forest City, Iowa.

SEAPLANE: J-5 Waco Straightwing on de luxe Edo floats. 90 hours since motor major and ship rebuilding. 85 gallons gas; water rudders; landing gear. Price, $1,850: trades considered. George Pearson, Roosevelt Field, Mineola, New York.

WACO GXE 10: OX-5, Millerized, equipped with semi-air wheels, new propeller, extra instruments: air speed, compass, pitch and bank indicator. Just relicensed. Plane and motor in excellent condition. Write for further details and snapshots. Stroh and Goodman, 324 S. 16th St., Lincoln, Nebraska.

WACO J-5: Just relicensed. Silver wings, red fuselage. Latest model. Semi-airwheels, brakes, metal propeller, speed ring, electric starter; standard instruments, plus turn bank, rate climb. Total time, 450 hours. Ringel Flying Service, 917 Bigelow, Peoria, Illinois.

WACO CABIN: 1936 Standard, Jacobs-powered, only 78 hours use since factory delivery in June. Perfect condition, over $1,400 extra equipment included. 70 gas, West port radio receiver, full electric night flying equipment, de luxe upholstery, steel prop; blue wings, fuselage; bank turn, rate climb. Cost $6,450. Sacrifice for $5,300. J. B. Steinel, 523 Flynn Building, Des Moines, Iowa.

WACO 10: OX-5. Licensed August, 1937. Cleanest one in this territory; recently recovered and motor majored. $500. Would trade on light plane. Highland-Detroit Flying Service, 16733 Hamilton, Detroit, Michigan.

WACO GXE OX-5: Perfect, polished fuselage; ship 330, motor 150 hours; steel prop, extra motor and prop. Bargain, $595: licensed to July, 1937. Will deliver for expenses. Olan Jacobs, Smith's Basin, N. Y.

1934 WACO DE LUXE Cabin: 225 Jacobs engine; ambulance equipment; Kollsman; lights and flares; thermocouple; 70-gallon tanks; turn and bank; Diana cream paint. Ship and motor in perfect condition. $3,500 flyaway San Antonio. This airplane cruises at 130 at 1850 r.p.m. Being replaced with 1936 demonstrator. Hangar Six, Inc., Stinson Field, San Antonio, Texas.

WACO TEN: OX-5. Excellent condition, licensed to April 1, 1937. $475. Hangar Six, Floyd Bennett Field, Brooklyn, N. Y. G. Zelnick, 1143 Bay Ridge Avenue, Brooklyn, New York.

WACO TEN: New engine. Covering perfect. Airwheels, compass, airspeed. Ship in perfect condition. Three hours on engine since new. Trade for car or $375 cash. Joe Medley, 3892 Beniteau, Detroit, Michigan.

FOR SALE: Cracked Waco F, Warner engine. All parts here. Glober Air Service, Municipal Airport, San Angelo, Texas.

35 WACO STANDARD Cabin: Jacobs powered. Left factory April this year. Used only last few months. 130 hours total time. 15 hours use since factory top overhaul on motor. Ship has never been damaged in any way. Has RCA radio, turn and bank indicator, retractable landing lights, flares, wheel pants, oversized tires, 70-gallon gas tanks and is licensed for five persons. A beautiful ship and practically new at a reasonable price. T. M. Stoner, 328 Gale Street, Aurora, Illinois.

WACO 90: Approved 26 x 5 Bendix wheels with brakes and new tires. Millerized motor. Licensed June '37. $450. Wayne Pyle, St. Elmo, Illinois.

WACO F, 125 WARNER: Excellent condition; air speed, compass, speed ring, turn and bank; priced to sell. D. E. Fisher, 1318 Market Street, Williamsport, Pennsylvania.

WACO TEN OX-5: Excellent condition; recovered '35; fuselage rubbed finish; 30 x 5 wheels, duals, cockpit covers. Licensed till July 15, 1937. Real buy at $485. John O'Brien, Greenville, Ohio.

WACO CABIN: Continental 210. Built 1934. Just relicensed. Beautiful gray and blue paint job. Bank and turn, rate of climb, landing lights, starter, flares, radio. $3,275. Will finance or take trade. St. Louis Flying Service. Incorporated, Lambert Field, St. Louis, Missouri.

1936 CUSTOM WACO demonstrator; 285 Jacobs, radio and extras; 60 hours ship and motor; priced for quick turnover. Waco F: 125 Warner; 31 hours since major; total time ship and motor, 550 hours; Hamilton steel prop, Heywood air starter, wings and tail surfaces recovered. Priced right. Waco 34: 225 Jacobs; ship just reconditioned at factory; many extras, special paint. Price, $3,500. Bush, 5214 W. 63rd Street, Chicago, Illinois.

FOR SALE: 1933 Waco Cabin with Continental engine which has just been overhauled and completely modernized by factory. Extra equipment: Landing lights, flares, bank and turn, wheel pants and steel propeller. Hand-rubbed finish in excellent condition. $3,300 at duPont Airport, Wilmington, Delaware.

OXX-6 WACO: Plane just licensed; motor has only 88 hours total. Real buy at $485. Taperwing Waco, $1,100. Pioneer Aviation Company, Airport, Syracuse, New York.

WACO C-5: Cabin; 225 Jacobs. Kollsman instruments, landing lights, radio, wheel pants; 10 hours since major. Will take trade. Salzman Aircraft, City Airport, Detroit, Michigan.

WACO 1936 STANDARD: Jacobs; pants, 70-gallon tanks, with or without pontoons and seaplane tail group. Time under 200 hours. New in April. Best offer takes it. Write or wire Dan Wallace, Hillcrest Road, Santa Barbara, California.

WACO 1935 CUSTOM Cabin: Jacobs 225 h.p. demonstrator, 190 hours, 5 hours since overhaul. New type rings installed. Extras: bank and turn, rate of climb, special 70-gallon gasoline tanks, landing lights, flares and RCA radio. Wonderful condition throughout. Must be seen to be appreciated. The H. C. Robbins Company, Waco Distributors, Cleveland Airport, Cleveland, Ohio.

WACO F's: Warner, Kinner, Menasco; also J-5 Straightwing; all equipped with starters and rarin' to go. Write or wire Salzman Aircraft, City Airport, Detroit, Michigan.

WACO CUC: 1935 Custom, fully equipped; Wright 285, controllable propeller, radio, 95 gallon gasoline tanks, blind flying instruments. Priced to sell. Write or wire Dan Wallace, Hillcrest Road, Santa Barbara, California.

1934 CUSTOM CABIN Waco: Wright 1760-R; full blind and night flying equipment, wheel pants; Curtiss blue with Diana cream trim. Total time 275 hours. Complete overhaul at 175 hours. Price, $4,200. Leech Aircraft, Inc., Roosevelt Field, Mineola, New York.

WACO CABIN PHOTOGRAPHIC Ship: CJCS 1935 Standard; one owner; Wright 285; silver finish; convertible for regular or photographic service. Extras include Kollsman sensitive altimeter, directional gyro, bank and turn, Eclipse generator, Kollsman compass, steel prop, 30-gallon extra gas tank, rate of climb indicator, night flying equipment; ship and motor less than 300 hours since new; perfect condition, never crashed. Available for immediate delivery; priced to sell. W. S. Wilson, Akron Airport, Akron, Ohio.

WACO F-3: Jacobs. Just relicensed; never cracked. $3,350. Time on engine and airplane, 196 hours. Pioneer instruments, including bank and turn. Private owner. Will show ship at North Beach. A. C. Bentley, 14 East 90th Street, New York, N. Y. Phone: Atwater 9-1919.

WACO CABIN: 210 Continental; directional gyro; flares, landing lights, radio, 70-gallon tanks, bank and turn, rate of climb; 475 hours, 130 hours since major. Virginia Air Service, Inc., Warrenton, Va.

WACO 10: OX-5. Licensed, in perfect condition. Special landing gear with semi-airwheels. $500 cash or will trade for light plane. William Ledger, 102 Whittemore St., Pontiac, Michigan.

WACO CUSTOM CABIN: New Jacobs engine, fully equipped, including 3-band radio and transmitter. Also ambulance stretcher. Condition like new. Akron Airways, Airport, Akron, Ohio.

WACO A: Late 1933 Jacobs; 20:00 since major; radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition; price, $2,000; will consider trade; can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO STANDARD CABIN: 1936. 4 months old. Like new. Jacobs 225. Total time 60 hours. Bank and turn, rate of climb, thermocouple. Waco vermilion with blue trim; polished fuselage. Price, $4,000. White Flying Service, Caldwell Airport, Caldwell, N. J. Caldwell 6-1560.

Wallace

WALLACE B: 330; 3PCLM. Kinner K-5, all heads reinforced. Fahlin prop. Consolidated panel; airspeed; Bendix wheels, brakes, tail wheel. Folding wings. Good shape. NC license. $550 cash; no trades. Foster Adams, 1613 Johnson Street, LaCrosse, Wisc.

Miscellaneous Aircraft

Aeronca, American Eagle, Aristocrat, Bellanca, Bird, Buhl, Cessna, Cub, Curtiss Robin, Driggs, Fairchild, Fleet, Great Lakes, Lambert, Lockheed, Pheasant, Pitcairn, Rearwin, Ryan, Spartan, Star, Stearman, Stinson, Travel Air, Waco.

TRAVEL AIR SPECIAL 4000: J-5, licensed, good condition. Full airwheels, with brakes, steel propeller, (just etched), speed ring, $625. Bird, Kinner K-5: Good condition, recently overhauled, airwheels, $9.50. Fred Moller, Middletown, Connecticut.

J6-5 ROBIN: Full airwheels, plenty extras, $1,150. C-3 Aeronca, full airwheels, $600. OXX-6 Waco, recovered and perfect, $550. All licensed. Treaty City Airport, Greenville, Ohio.

WACO F, K-5 just majored, airspeed, compass; licensed August, 1937; $1,200 cash, Skis, $100. OXX-6 Eagle, $450. Monoprep, majored, $450. Want Stinson Jr. or Waco C. Ralph Brichta, Curtiss-Wright, Milwaukee, Wisconsin.

WACO OX-5, 450 hours. Good fabric, good prop. Motor just overhauled. General condition good. Taylor Cub E-2, just licensed. Cub J-2, new August 1, 1936. J. Willard Miller, Lock Haven, Pennsylvania.

BARGAINS: Warner Waco F, 2 hours since major on plane and motor; price, $1,600; Continental Taylor Cub, very good, $650. Aeromarine 50 h.p. Rearwin Jr., just relicensed, $650. Wanted at once: 10 airplanes for cash; crack-ups considered, also Cub, less motor. Harrisburg Air Service, Penn-Harris Airport, Harrisburg, Pennsylvania.

FLEET, WARNER 125: 135 hours since motor completely overhauled. Stinson SM8A, Lycoming; motor has 49 hours since complete overhaul; shielded; night-flying equipment. Wasp B, 420 h.p., 200 hours since major; total time 1600 hours; $550. Monarch Air Service, Municipal Airport, Chicago, Illinois.

TAYLOR CUB: 1936; 60 hours; like new. Waco B.S.O., J6-5; perfect; 3-place, open. Write for details. Jerry Bouse, Willoughby Airport, Willoughby, Ohio.

FAST CABIN CESSNA: Wright J-5; Waco F; '35 Aeronca, $900. Taylor Cub, $650. Bull Pup, $400. J6-5 Travel Air, $1,400; 850 x 10 semi's, brakes. All ships very clean and relicensed to late '37. Alford Flying Service, Stinson Airport, LaGrange, Illinois.

WACO F: Warner engine, just majored. Steel prop. $1,450 cash. Warner Monocoupe, steel prop, racing landing gear, condition good; $1,150 cash. Reg. Pattinson, St. Elmo, Illinois.

CABIN PLANES: Curtiss Sedan, $1,000. Fairchild, $900. Challenger Robins, $850. Velie Monocoupe, $550. Star Cavalier, $600. Ryan, $1,000. Terms arranged. Pioneer Aviation, Syracuse, New York.

J-5 STEARMAN: Fine condition throughout, $1,150. Pitcairn Autogiro, practically new, one owner, $1,650. Terms trades, delivery. AERO DIGEST, Box 2414.

Miscellaneous Aircraft

REPOSSESSED 1935 E-2 Continental Cub; $1,000, $200 down. Travel Air 150 h.p. 3-place biplane, $1,600, $200 down. Ryan 5-place J-5 monoplane, recovered, beautiful condition, $1,600, $500 down. 1936 Porterfield, like new, $1,500, $500 down. 1935 Porterfield, 50 hours, only $1,100, $300 down. Cavalier two-place, Velie 65 h.p., monoplane, recovered, $800, $200 down. Eaglerock OX-5; just expended $230 repairs with recover; $450, $150 down. Balance easy monthly payments. Information sheets sent on request. Also J6-7 motor, just majored. Continental Cub and Cirrus Mark III motors. Sikorsky S-38, Klemm, Stinson 1933 Reliant, Moth and Avian parts and many instruments offered, no down payment plan. Aviation Finance Co., Hemlock, New York.

SEVENTY-EIGHT real buys at Pioneer Aviation Company, Airport, Syracuse, New York. Send for free list of the best used airplanes in the United States.

WACO F, WARNER 125 h.p.: Stinson S; Stinson SM-2-AB; Driggs, Rover powered; J6-5 Aristocrat; OX-5 Travel Air; several others; send for list. 26 x 11 airwheels, complete. Air Activities Airport, West Chicago, Illinois.

FOR SALE OR TRADE: Stinson S, Waco F, J-5 Pitcairn, Taylor Cub, Fleet, OX-5 Pheasant, Kinner K-5 front exhaust engine, just majored. Wanted: Lambert Monocupe in need of repairs. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

J6-5 WACO, J6-5 Robin, J6-5 Travel Air, J-5 Travel Air. Lambert Monocoupe. Great Lakes. OX Waco, OX Travel Air. Warner Waco F. Priced to sell or trade. Jack's Aero Brokerage, South Omaha, Nebr.

HUNDREDS OF PLANES: OX-5 jobs, $75 up. Terms, trades. Send 25c for complete directory containing owner's price, name and address. Used Aircraft Directory, Athens, Ohio.

CURTISS-WRIGHT Travel Air 16-K: Kinner 125 h.p. Majored, 3-place, $1,375. Spartan low wing side-by-side, excellent and relicensed, Jacobs 55 h.p. majored, $900. Cub A-40-2, enclosure, priced to sell, $825. Foster A. Lane, Port Columbus, Columbus, Ohio.

FOR SALE: Jacobs Cabin Waco, Jacobs Waco F-5, Warner 125 Monocoupe, Warner 145 Monocoupe, Stinson SM8A, Stinson 1934 Reliant, Lambert Monocoupe demonstrator, Bellanca Skyrocket, Lockheed Air Express, Lockheed Vega, Taylor Cub, J6-7 Travel Air, J6-5 Straightwing Waco. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

ENGINES

Aeronca, Kinner, LeBlond, Szekely, Wright.

AERONCA MOTOR: E-107A. Good condition; seven hours total time. $100. Barr-Stanislaw, Inc., Detroit City Airport, Detroit, Michigan.

WRIGHT CYCLONE F-2 with dynamic balanced crankshaft, overhead oiling system, starter, generator, vacuum pump, and fuel pump, complete. Engine now disassembled. Will sell as is or assembled and run-in on test stand ready for flight. Also Hamilton controllable propeller hub for this engine. AERO DIGEST, Box 2406.

FOR SALE: Kinner K-5, front exhaust. No time since overhaul. A-1 shape. $300. T. W. Danton, Box 298, East Detroit, Michigan.

LE BLOND 60 MOTOR: Just majored, new rings, rocker arm bushings, etc. $100, for quick sale. George A. Hanna, 78 Beech Street, East Orange, N. J.

SZEKELY 45 H.P. engine: Overhauled by licensed mechanic. Has had 200 hours. Henry J. Walker, 600 South Oak Park Avenue, Oak Park, Illinois.

WANTED TO BUY OR TRADE

WANTED: Airplane parts and supplies. Lycoming, Wasp, Wasp Junior engines and parts. Tools and shop equipment. T A C A, Tegucigalpa, Honduras, C. A.

WANTED: 65 to 125 h.p. motor. Or parts for Velie motor. Or sell Velie Kari-Keen with broken crankshaft. Cash. Dale Walter, Box 184, Severy, Kansas.

WILL BUY good condition primary or secondary glider. Also interested in auxiliary equipment. D. Priest, 41 Judson Street, Canton, New York.

WANTED: 1929 Velie Monocoupe with or without engine, licensed or unlicensed. Have you any parts for same? James Melton, Box 12, Marcus Hook, Pennsylvania.

WANTED: Three used Lycoming motors. At least two equipped for variable pitch propellers. Cash. Prof. J. D. Akerman, Dept. Aero. Engineering, University of Minnesota, Minneapolis, Minnesota.

WANTED: For cash, J-5 ship less motor. Give complete history, condition, etc. Must be bargain. Or sell J-5 motor, recently majored, Hamilton prop. Consider trading motor and prop on good ship. Howell Bros., Pampa, Texas.

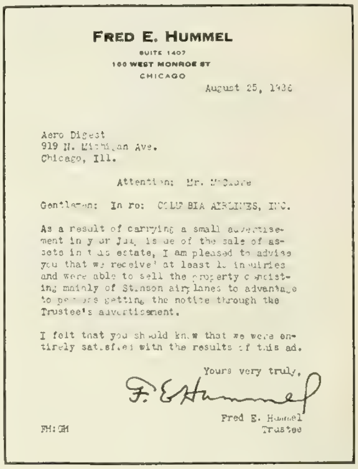
WANTED: DE LUXE FLEET, with Warner or Kinner 125. With dual brakes, instruments, air wheels, extra tank. Must be late model and in good condition. Will pay cash. AERO DIGEST, Box 2410.

WANTED TO BUY: Complete Station Kit for Cyclone F engine; also a propeller adjusting table for controllable and fixed F Cyclone. AERO DIGEST, Box 2407.

WANTED TO PURCHASE: Compressor for spray gun, sander and cleaning. AERO DIGEST, Box 2408.

WANTED: NC plane under 200 h.p., for general use. Give details and cash price. Meyer, 122 South Sixth Street, Brawley, California.

HAVE "MATTHEWS" 38 cabin cruiser, with Sterling "Petrel" engine in immaculate condition. Will trade for Waco cabin or Stinson. Planes offered must be in perfect condition. Boat recently appraised at $3,500. A. C. Esenwein, North East, Pa.



FRED E. HUMMEL
SUITE 1407
100 WEST MONROE ST
CHICAGO

August 25, 1936

Aero Digest
919 N. Michigan Ave.
Chicago, Ill.

Attention: Mr. M[illegible]

Gentlemen: In re: COLUMBIA AIRLINES, INC.

As a result of carrying a small advertisement in your July issue of the sale of assets in this estate, I am pleased to advise you that we received at least 1[illegible] inquiries and were able to sell the property consisting mainly of Stinson airplanes to advantage to persons getting the notice through the Trustee's advertisement.

I felt that you should know that we were entirely satisfied with the results of this ad.

Yours very truly,

F. E. Hummel

Fred E. Hummel
Trustee

FH:GM

WANTED: Blades for Pitcairn Autogiro, Model PAA-1. Consolidated Aircraft Repair, Inc., Municipal Airport, Fort Wayne, Indiana.

WANTED TO BUY: Pontoon Aeronca wanted; or floats and struts for C-3 Aeronca. Central Florida Flying Service, Orlando, Florida.

WANTED: Will pay cash for K-5 Eastman aerial camera or other air mapping equipment for laboratory or field use. AERO DIGEST, Box 2412.

WANTED: J6-9-E and J6-7-E engines. Also interested in either model R or model Reliant Stinson. Give full description and price in first letter. We have one J6-9-D and two J6-7-D engines with recent overhauls for sale or trade. Write or wire Mackey Flying Service, Findlay, Ohio.

PARTS WANTED for late 1935 Taylor Cub with A-40 Continental engine. Right wing; propeller; cowling. State condition and best price in first letter. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

WANTED: Any licensed airplane. Will pay cash or trade 1934 Ford V-8 truck, 1½ ton van body and cash. Turn that unused airplane into cash and earning power for the winter. Aviation Finance Co., Hemlock, New York.

WANTED: Cracked Wright J-5 or J-5 parts. Must be cheap for cash. Have surplus of certain J-5 parts to sell. Roger Gardner, Airport, Poughkeepsie, N. Y.

WANTED: Aircraft engines and parts. Highest cash prices. Air-Parts, Inc., Glendale, California.

WANTED: Avro-Avian. State description, condition and lowest cash price first letter. If your wife has been bellyaching about your flying, here is your chance to stop her griping. E. D. Shumaker, Scio, Ohio.

WANTED: Late Velie M-5 or parts. Cash. Describe fully. Al Curran, 27 Leland Street, Malden, Mass.

WANTED: Cub, Aeronca, Fleet or Monocoupe with or without floats or small amphibion, for cash. Must be good but a bargain. AERO DIGEST, Box 2432.

WILL TRADE Great Lakes for Lambert Monocoupe. Ship in first class condition. Special hand rubbed finish. Fifty hours since major. Give complete details and photos. R. P. Tucker, Municipal Airport, Denver, Colorado.

WANTED: Waco Cabin 210; 3-place open or closed plane; Kinner K-5 parts; Fleet parts, enclosure. Have Waco Cabin 165 for sale. Lloyd Pierce, 2629 Fox Avenue, Fort Wayne, Indiana.

WANTED: Two- or three-place ship, licensed or identified. Air-cooled job preferred, good OX-5 or OXX-6 considered. O. B. Lancaster, Box 533, Spindale, North Carolina.

WANTED: J-4 crankcase. Other J-4 motor parts. Want one J-5 motor; can also use parts for J-4 Straightwing Waco. John Osterhouse, Mandan, North Dakota.

WACO PRIMARY GLIDER: Need fuselage, wing etc., or will buy complete primary ship and sell nosepiece, tail, wing. AERO DIGEST, Box 2423.

ENGINE WANTED: 100 to 150 h.p., weighing not over 375 pounds for unlicensed private sportplane. Give condition, specifications, operation figures. Howard A. Tubbs, Whitewater, Wisconsin.

WANTED: Upper right wing, right front strut, right axle for 100 Kinner 3-place Bird. Air Service, Inc., Johnstown, Pennsylvania.

WANTED: Wright & P. & W. engines and parts; also instruments and accessories. Cash waiting. Eastern Airplane Supply Co., 505 West 54th Street, New York, N. Y.

WANTED: Used Jaeger aviation clock, Kollsman sensitive altimeter; both with standard mount. Also wind-driven 12-V. shielded generator; 1-minute landing flare set. S. L. Pond, Roxbury, Conn.

MISCELLANEOUS SERVICES OPPORTUNITIES, OFFICES, ETC.

AERONCAS: New and used. We specialize in flying instruction; $5 per hour. 10% discount after completing our Home Study Course. Write for full particulars. St. Joseph School of Flying, Municipal Airport, St. Joseph, Missouri.

YOUNG MAN: Gentile only, whose qualifications fully meet our requirements, and who can finance own transport license course in our school, can obtain a part interest in our established business in exchange for six months' apprenticeship in our organization. AERO DIGEST, Box 2415.

EXCEPTIONAL OPPORTUNITY available to two high school graduates only: Transport license flight course, year's training toward mechanic's license, general airport management experience and room free at Florida airport, for $1,275 plus hard work. AERO DIGEST, Box 2416.

YOU MAY OBTAIN finance for one-half the purchase price on the sale or purchase of any airplane listed in this magazine, but not over $638 on any one plane. Also, we will repair for you and allow you to fly away, with no down payment, your airplane when completed. No OX-5 finances taken. Aviation Finance Co., Hemlock, New York.

FLYING JOBS for all our graduates. Need more. We have the least expensive system for acquiring training and getting a real flying job or starting a profitable aviation business of your own. Commercial course only $290. Free booklet. Bennett Air Service, Box 247, Hightstown, New Jersey.

SELL OR TRADE: 24-foot Sea Lyon speed boat, 115 h.p. Chrysler marine motor, 35 m.p.h. Excellent condition throughout. $800, or trade for plane. Earl E. Bach, Red Bank, New Jersey.

ATTENTION, NEW ENGLAND pilots: Dead storage at low rates, November to May. Write Cape Cod Seaplanes, North Falmouth, Mass., for details.

AN AIRCRAFT FACTORY, which is one of the leaders in the low-priced field, is considering opening a factory branch for the sale of its products in eleven northeastern states. A partner is desired with $10,000 cash to become Manager on a fifty-fifty basis in this branch, headquarters at Floyd Bennett or Roosevelt Field. Prices of products range from $1,500 to $3,000. AERO DIGEST, Box 2427.

ALLENTOWN - BETHLEHEM AIRPORT for lease: Operation and maintenance of airport (United Airs Lines stop) available January first. Splendid opportunity for right operator. Write Chamber of Commerce, Allentown, Pa., for details.

ATTENTION! Flying students! Big opportunity. Transport Flying Course, 1, 1A, 2A ratings. Master Mechanics course, Airport Management. Flying job guaranteed on graduation. Tuition, $1,495. Part time employment. Conrad Flying School, Winona, Minnesota. Oldest and best flying school in the Northwest.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs or individuals wishing to start flying business. Little or no capital necessary. Write Bennett Air Service, Box 247, Hightstown, New Jersey.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

GET AMAZING AVIATION Bargain Book: Save 0% to 60% on equipment, clothing, instruments, ewelry, propellers, plywood, fabric, wheels, tires, ools, helmets, goggles, tubing, torches, rivets, luminum, books, tanks, everything from suits to uts. Get my big bargain book today; send one thin ime—returned with your first order. Karl Ort, 626 V. Poplar, York, Pennsylvania.

LE BLOND 90: Completely majored, no time since. Also pair of 22 x 10-4 Goodyear Airwheels with tubes, ubs and adapters, practically new. E. Renfroe, 4546 Michigan Avenue, Chicago, Illinois.

LYCOMING R-680: Have any part for Lycoming. Will trade for Warner Scarab parts. Two 45 h.p. Szekely heads and magnetos, $5 each. NACA cowling or Warner Super Scarab, $15. Hal Knoche, 710 Richards Road, Municipal Airport, Kansas City, Missouri.

NEW & USED Lycoming parts: Substantial saving n used parts. Sioux Skyways, Sioux Falls, South Dakota.

CURTISS OXX-6 motor, mount, cowling; fine condition; licensed Challenger Robin parts. Wanted: ving for Velie Monocoupe. Russell Erickson, 4122 West 8th Street, Duluth, Minnesota.

0 x 3, 500 x 3, 500 x 4, 14 x 3 tire and tube, $5; wheels, $3.50. 24 x 3, 24 x 4, 24 x 5, 28 x 4, straightide non-skid tire, $3 each. Larger sizes, $5. All ize wire wheels, from $1 to $3. Standard steel propellers, all sizes, $50 to $150. Variable pitch Hamilton propeller, best offer. Motors and parts for Wright Cyclone Model R-1820-F. Wasp, Hornet, Liberty, Hisso, OX-5, OXX-6, Hall-Scott, Mercedes, Whirlwind and other makes of air-cooled motors. Two new 3-cylinder SR-3 Szekely's, complete, $250 each. New Siemens-Halske 5-cylinder radial motors, in original crates, 70 h.p., $250. New AC, Champion and Splitdorf spark plugs, 20c each. Motor generators, 10 volts in-put, 300 volts output, $10. New Fahrenheit temperature gauges, 12 feet long, $1.90. New Tachometers, $5 each. GE compass, $4. Oil and fuel gauges, $1 each. B2-3-4 engine throttles, 2 to $3.50 each. Choke controls, 50c. Scintilla, Bosch - to 12-cylinder magnetos, $25. Irvin parachute with pack, $60. Turnbuckles, shackles, clevis pins, nickel steel bolts, low quantity price. 30 amperes. 2-volt streamlined generators, $6.50 each. 28- and 0-gauge sheet dural, 45c per pound. See us for bargains. Crawford Airplane Supply Company, Venice, California.

FOR LONG DISTANCE flights and aerial navigation: Slightly used sextant, "Platz", Hamburg. Bubble and horizon sights. Extraordinarily good results in aerial and marine work. $200 cash. AERO DIGEST, Box 2422.

WHILE THEY LAST: Pioneer oil temperature gauges, guaranteed satisfactory, $3.10. Scintilla magnetos, 5- and 7-cylinder, any type, serviceable, 7. NAS5A carburetor, $5. Velie M-5 cylinder and head. $6.75. Get your order in early. Snyder Aircraft Company, Municipal Airport, Chicago, Illinois.

SPERRY DIRECTIONAL GYRO: $175. Sperry artificial horizon, $190. Pioneer rate of climb, $50. Manifold pressure gauge, tachometer, compass, airpeed. No time since complete factory overhaul. AERO DIGEST, Box 2424.

FOR SALE: Szekely engine, disassembled but complete, $250. Eaglerock parts price list on request. Special Eaglerock right upper wing, new, covered, undoped, $95. Two Eaglerock fuselages, new, covered, doped, $250 each. Large surplus stock steel tubing, spruce, bolts, ⅛ inch control cable, etc., prices on request. Aircraft Mechanics, Inc., 3200 North Nevada, Colorado Springs, Colorado.

FOR SALE: Nearly complete Genet motor parts; also set airwheels, 16 x 7-3 with 4-ply tires. Harley Stewart, c/o Livingston Airways Corporation, Waterloo, Iowa.

BULL PUP PARTS for sale cheap. Fin, tail assembly, ailerons, landing gear, wheels, tires, etc. Partially complete Szekely SR-3-O. Sell as is, or parts. OX-5, Millerized, American Eagle, $300. Chin Non, Lewistown, Montana.

AIRPLANE PARTS for sale: Great Lakes, Waco cabin, Waco 10, Travel Air sport trainer, Travel Air 2000. Engine Parts: J-5 motor mount and oil tank for OX-5 Travel Air conversion to 4000. Two new J-5 magnetos, shielded. J-5 pistons, rear case, exhaust valves, cylinders. One Hammondsport OX-5 ngine, used very little. Cirrus parts. Four Kinner B-5 pistons. J-5 propeller hub. J-5 steel propeller, actory serviced. Lambert cylinders and pistons. Kinner K-5 crankcase and crankshaft. Kingsville Cabinet Shop, Kingsville, Missouri.

BARGAIN, OCTOBER ONLY: J-5 latest type rocker box covers, brand new, 20c each. J-5, J6-9 and all models Wasps, newly majored, export certificates. Parts for all above engines, new and used, owest prices. Write for lists. Lockheed Air Express, with or without Wasp, cheap. Plane just majored, xcellent condition. Eastern Airplane Supply Co., 05 West 54th Street, New York, N. Y.

AUTOGIRO ROTOR blades in good flying condition, and also other spare parts for Pitcairn PCA-2 autogiro. AERO DIGEST, Box 2413.

WHITTELSEY AVIAN wings, spars, motor mounts, etc. Cirrus American and English parts. J-5 parts. Kinner A-N specification nuts and bolts. Lionoil. Write your needs. Dick Schall, Berwyn, Maryland.

STINSON TRIMOTOR U and T parts: Pilgrim parts; propellers, 165 h.p. and up; carburetors, magnetos; Wiley 3-minute reconditioned flares, $20 each; J-5 cylinders; starters; reconditioned spark plugs; wheels, tires and tubes; Wasp and J-6 parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

PORTABLE HANGAR: Prefabricated wood and metal. Set it up yourself in a couple of days. The answer to low cost storage. $9.50 monthly; no down payment. Bennett Air Service, National Distributors, Hightstown, New Jersey.

DON'T BUY ANYTHING until you get Ort's 1936 Aviation Material Catalog. Prices are lower. Send thin dime today. (Canada 20c). Karl Ort, 624 W. Poplar, York, Pennsylvania.

POSITIONS WANTED

FORMER Government licensed mechanic desires work. Age 31; 4 years field and factory experience. Married; best of habits; know my job. AERO DIGEST, Box 2405.

TRANSPORT PILOT: Army trained; plenty of time and experience. Now engaged student instruction and passenger work. Will do anything for fair salary. AERO DIGEST, Box 2404.

YOUNG MAN: 25, would like work as apprentice mechanic in aircraft factory or repair station. Have had considerable experience in engine overhaul. Will consider anything, go anywhere. Can give references. Elwyn F. Rufener, Elmo, Kansas.

COMMERCIAL PILOT: 32, single; handy with tools; energetic and willing worker. Now employed. Speaking five languages fluently, Spanish included. Flying as a hobby since 1930. Never damaged a plane or injured a passenger, though had several forced landings. 135 honest hours. Seeks contact with an active aviation concern, offering opportunity for advancement. Salary secondary. Free to go anywhere. AERO DIGEST, Box 2417.

YOUNG MAN: Will work as apprentice mechanic for room, board and small salary. Some mechanical experience. Good references. Location immaterial. AERO DIGEST, Box 2409.

LC PILOT: 160 hours solo. 1 and 1A ratings, with welding and mechanical experience. Consider anything. Age 23, white, single. AERO DIGEST, Box 2425.

TRANSPORT PILOT: Age 25. 8 years' experience in aviation, instructing, barnstorming and charter flying. Desire connection with company or individual. Will go anywhere. AERO DIGEST, Box 2426.

LICENSED TRANSPORT PILOT: Age 19, graduate government approved school, wishes position flying. Go anywhere. Will accept reasonable salary. John Spoon, 538 Gainesboro Road, Drexel Park, Pennsylvania.

PARACHUTES FOR SALE

PARACHUTES: Irving and Switlik chutes, new and used. Wanted at all times: Used parachutes for cash. Describe fully. Air thrillers for airports, celebrations, etc. Thompson Brothers Balloon & Parachute Co., Aurora, Illinois. Established 1903.

HELP WANTED

WANTED: Fifty aircraft sheet metal men. Write complete experience to Box 2349, Tulsa, Oklahoma.

EXCELLENT OPPORTUNITY: Wanted: Young transport pilot with 4-place cabin plane for charter work and passenger work at growing airport. Must also be good instructor with likeable disposition. Salary on commission basis. AERO DIGEST, Box 2418.

TRANSPORT PILOT WANTED with light student plane to take over student concession at Poughkeepsie Airport. Vassar College two miles away. Excellent opportunity for aggressive young pilot. Roger Gardner, Airport, Poughkeepsie, New York.

WANTED: Man to analyze small biplane. Must be put in shape to be acceptable by the Department of Commerce. Located Michigan. AERO DIGEST, Box 2430.

INSTRUCTOR: For well-known Airplane and Engine Mechanics School, located in East. State full qualifications, references, etc. AERO DIGEST, Box 2431.

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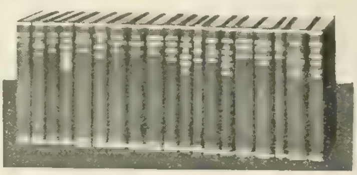

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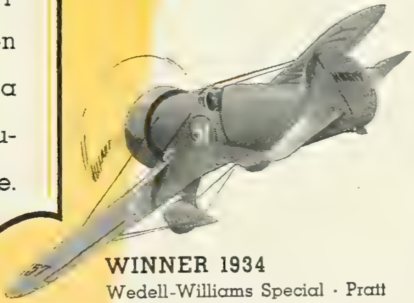

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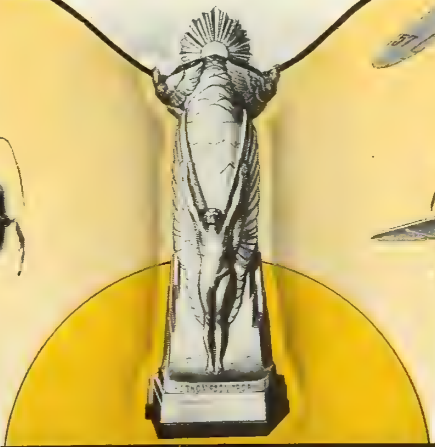

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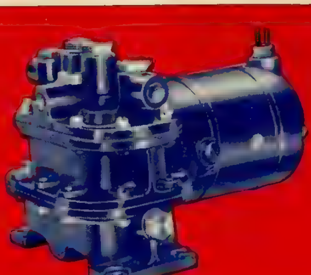
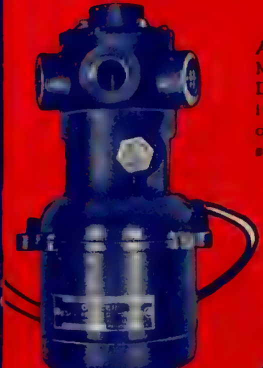


Above: Eclipse Propeller "Anti-Icer" — Pump (variable output) for application of ice removing fluids to propeller hub slinger and windshields.

Right: Eclipse Remote Control Rheostat (shielded) for propeller "Anti-Icer" pump.

Above: Eclipse Electric Motor Driven De-Icer Distributing Valve (with integral control valve) for operation wing and tail surface Goodrich De-Icers.



Left: Eclipse Electric Motor Driven De-Icer Distributing Valve (less integral control valve) for operation wing and tail surface Goodrich De-Icers.

Right: Eclipse De-Icer Oil Separator with integral regulating valve to control pressure to wing and tail De-Icers.

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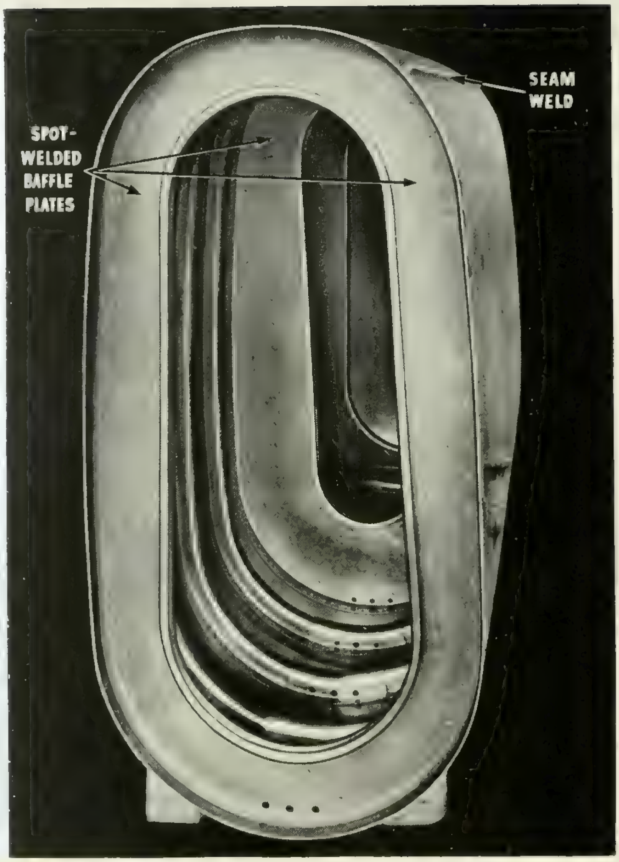

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Volume 29 Number 5

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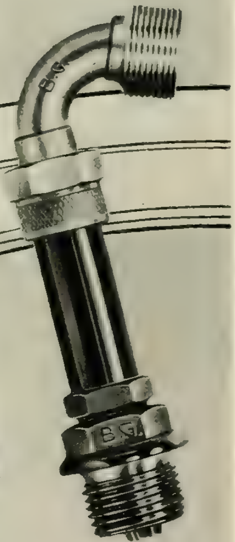

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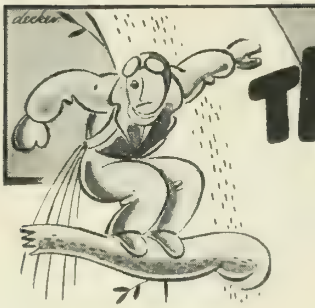
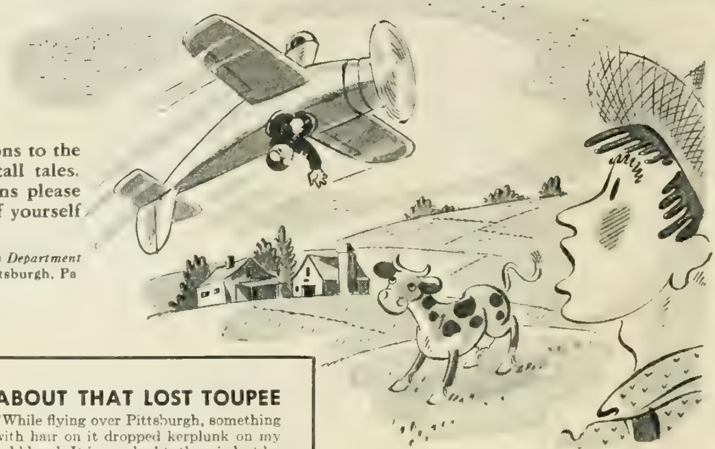


The Birdmen's Perch

Thanks, boys! We received a swad of contributions to the "Perch" last month, and nine out of ten were tall tales. That's dandy, but will future Baron Munchausens please salt each whopper with a squib of *news*, either of yourself or some fellow birdman? Address your letters to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa



IS-MY-FACE-RED DEPARTMENT

Ever hear the one about the pilot who was doing taxi work at a sea-side resort last summer? Seems his wife was a nifty platinum number who kept the male guests of the hotel in a turmoil—much to the disgust of her hubby.

One day, when flying over the beach, he saw his beloved lolling on the sand with a chap who, to his jealous eyes, was behaving too much like one of the family. With anger rising, he banked around and headed toward the absorbed couple in a fast dive, thinking to give the chap a bit of a scare. And he succeeded, all right!

That evening as he approached the hotel his wife met him, with a steely gleam in her eye. "That, you idiot, was father! He came up from the city today."

—C. E. L.

MORE STRANGE CARGOES

Among odd items recently carried by air express are

Maggots and germs.
One ton of coal.
Ladybugs from California to combat a fruit blight in Florida
Blackbottom custard pie.
Pheasant eggs from England to a Pacific Coast hatchery.
Lobsters.

NOTE: *Sensible* cargo for *any* plane: Gulfpride Oil and Gulf Aviation Gas

ABOUT THAT LOST TOUPEE

"While flying over Pittsburgh, something with hair on it dropped kerplunk on my bald head. It is, no doubt, the wig lost by the fellow mentioned in your July 'Perch'. "The girls liked me so well with my new thatch, that I intended to keep the toupee and say nothing. But lately I have been putting Gulf Aviation Gas on it, and the hairs are starting to grow. When they get long enough, I will clip the wig, stick the hairs on my head, and return the toupee to you."

—J. E. K.

NICE GRAVE, CLOSE BY

"Returning home from an air meet a few days ago, the engine suddenly stuttered and gargled, revving downward a couple of hundred turns so that I began to look for a likely place to sit down. And there, right off our right wing, was the most beautiful cemetery you ever saw."

—Robert M. Mead, White River Junction, Vt.

THIS MONTH'S WHOPPER

"It was cold, grey dawn. The Arbutus Tri-Motor was sitting on the runway In a short while, it would take off.

"The proposed flight was to be upside-down, non-stop, non-refueling, around the world. A cheer broke out as we saw the pilot, Printwhistle Q. Slowstarter, come out of the hangar. We cheered even louder when we saw he was sober.

"The engine started. Suddenly it stopped. At last our technical staff discovered that the huge gas tank (8 gal.) was empty.

"Failure, dismal failure, stared us in the face, for the airport was miles from a gas pump, in the middle of a Louisiana swamp. Suddenly a yell of glee came from one of the mechanics He had found that our portable electric light power generator had two gallons of gas in its tank.

"Best of all it was that old Gulf Aviation Gas. So we put it in the Arbutus; Printwhistle Q. Slowstarter gave her the soup; and the flight was on.

"We trooped into the hangar, lit up smokes, and turned on the radio. About two hours later this announcement knocked us right off our seats:

"FLASH—Printwhistle Q. Slowstarter has just completed a non-stop, non-refueling, upside-down flight around the world, by way of the North and South Poles. But he just made it, folks, he JUST made it! There is only a half a gallon of gas left in the plane's tank."

—C. A. Piedra, Jr., New Orleans, La.

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said Fowler Barker, Secretary and Treasurer of the Air Transport Association of America, in speaking of PARKS AIR COLLEGE.

The Air Transport Assocation of which Mr. Barker is Secretary and Treasurer, has a membership of 18 major airlines that, together, fly more miles, by a wide margin, than all other airlines of the world. Mr. Barker, after an entire day at Parks, made a statement that included this paragraph:

> "It was a revelation to me to see what thoroughness and esprit de corps exists at Parks. I have been in aviation, and nothing else, for twenty years, but I feel I would like to take, and would profitably, the Professional Flight and Executive Course, in order to be brought up to date completely on the tremendous technical progress made by the air transport industry."

The four letters from which the following statements are quoted, all received in a single day, were addressed to Oliver L. Parks, President of Parks Air College.

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The President of an airline that flies ten million and more airplane miles each year wrote:

> "You are doing a good job at St. Louis and I am hopeful your school will have the success it deserves."

The General Sales Manager of another major airline wrote:

> "As we all well know, the industry needs trained men and needs them badly. It should be the source of much satisfaction to you to know you are contributing so helpfully to this increasingly important branch of modern transportation."

The Superintendent of Service and Maintenance of a third airline wrote:

> "I hope to be able to visit your School very shortly, and will discuss with you at that time the possibility of securing graduates from your School to fill various positions in our organization."

Ever increasing numbers of great planes are being built to satisfy the demands for air transport service.

"ABREAST OF THE TIMES", SAYS D. C. OFFICIAL

A high-ranking official of the Department of Commerce of the United States, who, through personal inspection, has long been familiar with Parks Air College, wrote:

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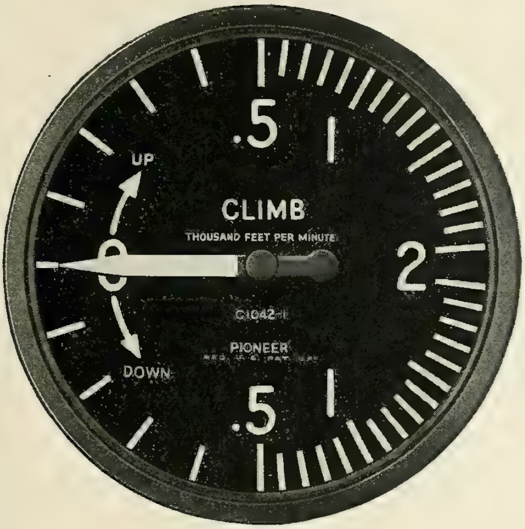

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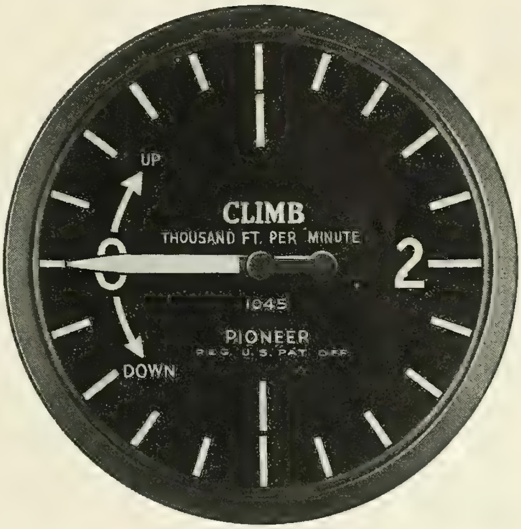

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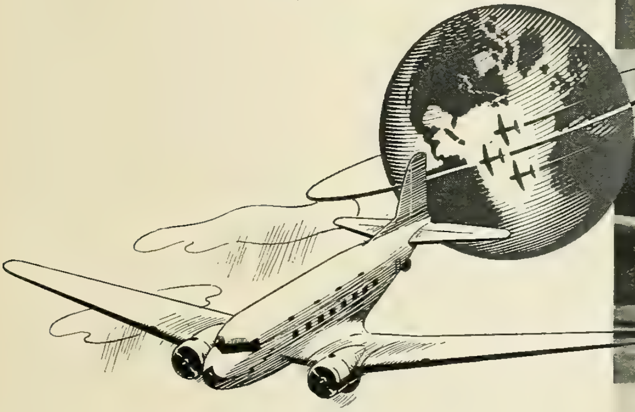

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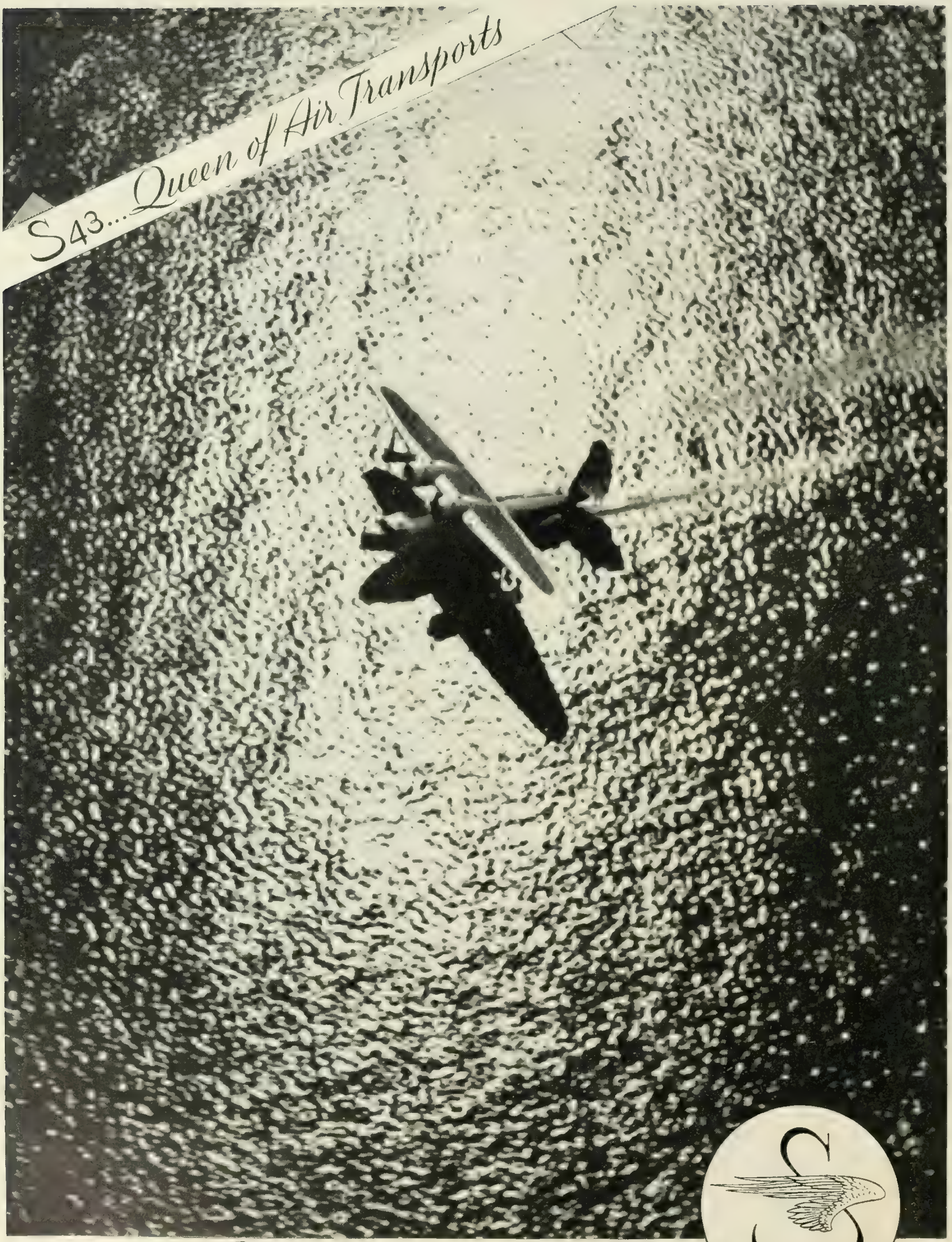
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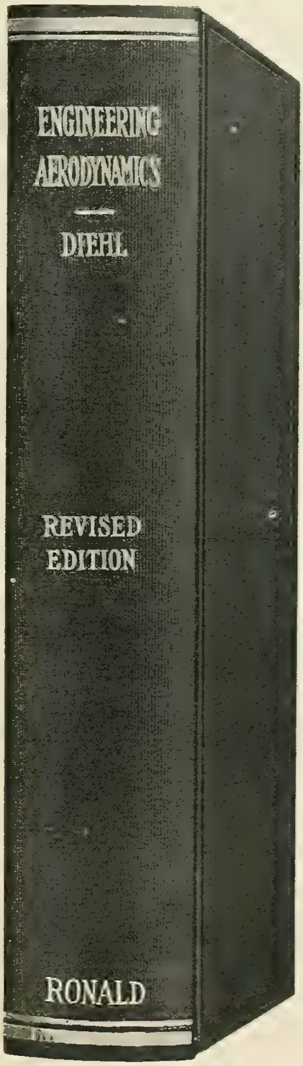

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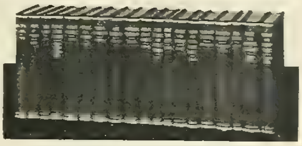

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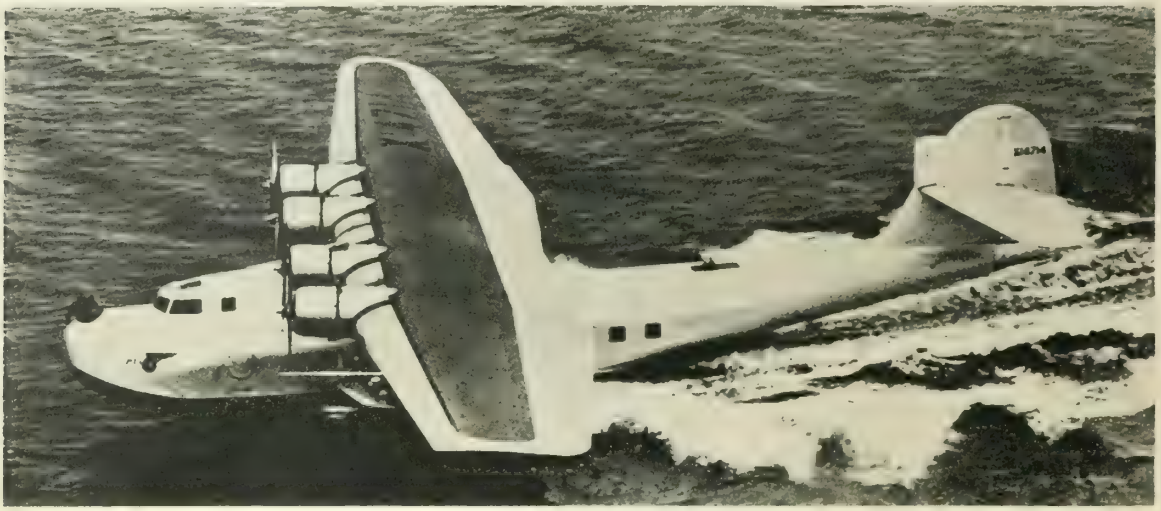

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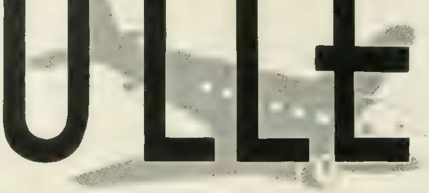

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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone Plaza 3-6969. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5. Copyright 1936 by Aeronautical Digest Publishing Corporation.

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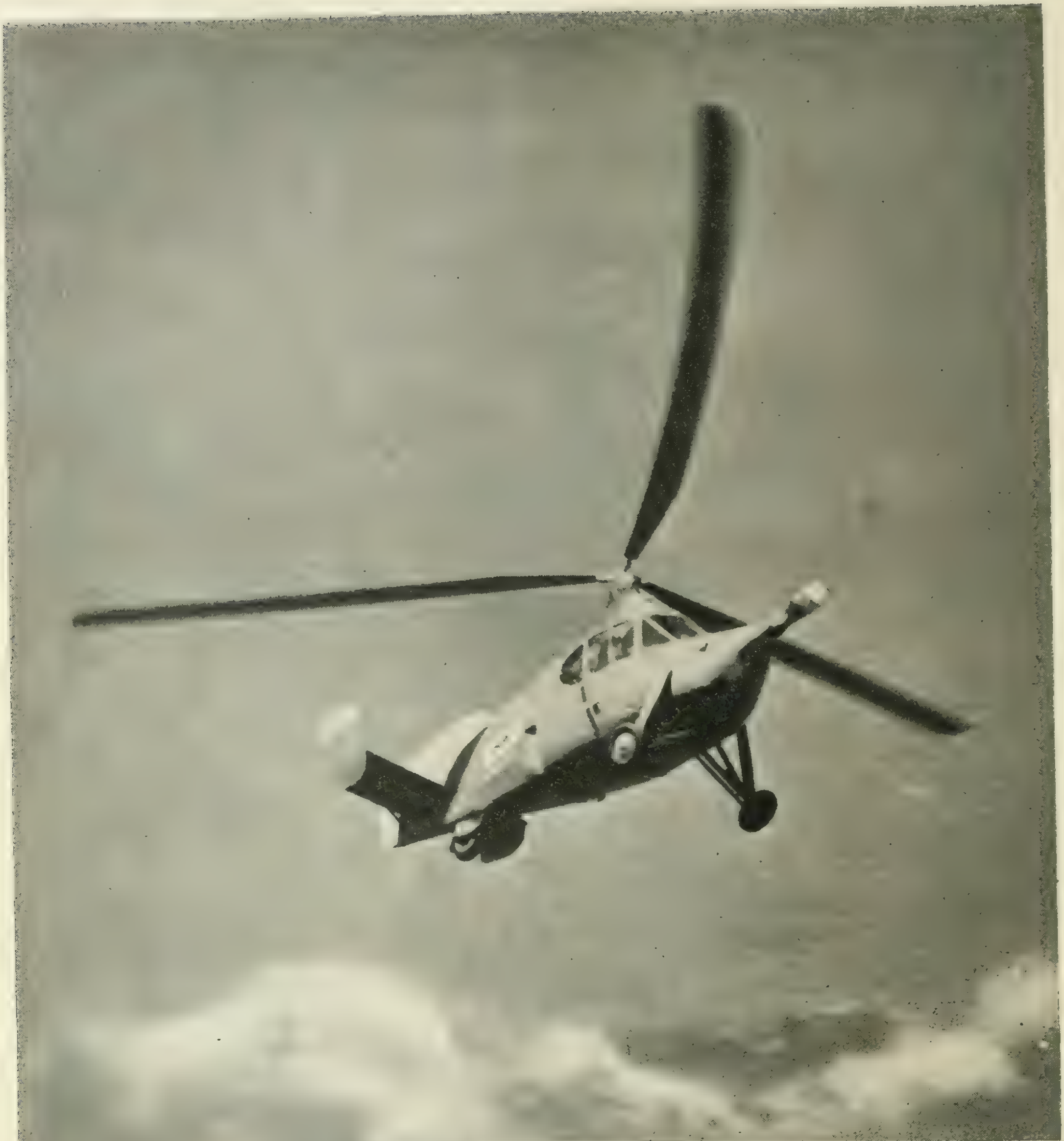
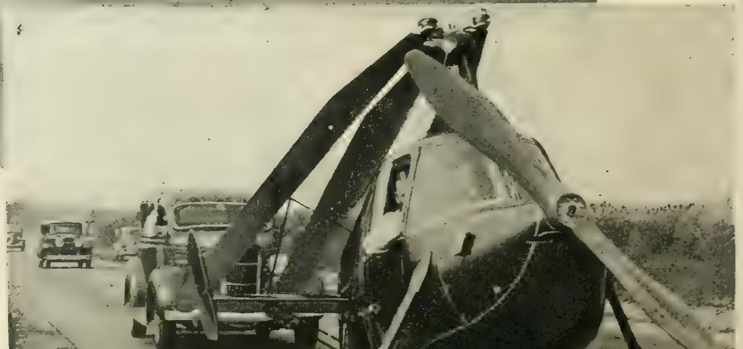




Acme photos

Latest development of the Autogiro Co., the 2-place "roadable autogiro". Powered by a Pobjoy engine aft of the pilot, it has an airspeed of 90 mph. With its rotor blades folded, it may be driven as an automobile on the highways; forward wheels are steerable and traction is supplied through the tail wheel

AIR—HOT AND OTHERWISE

Elliott, How About That Contract?

FRANK A. TICHENOR

● Of course Elliott Roosevelt denied the story carried in this magazine last month. We expected it. "No such contract."

Interviewed by wire services, Elliott denied everything except that he had contracted to be a salesman for Fokker.

There were no military planes involved, no governments, no cash money. He could prove this by a contract in the hands of Charlie Michelson—but in New York, at Democratic National Headquarters, Charlie denied he held the contract after a copy of the document in the Nye Committee's hands appeared in the columns of the New York *Sun*.

Elliott denied having received any money—although we offered (1) a letter from him stipulating immediate payment of $5000; (2) a receipt signed by him for the same $5000; (3) a copy of the contract signed by him again identifying him as the recipient of the $5000.

Incidentally, the newspapers on October 25 credited Elliott's representative, Mr. Stratton, with a contribution to the Democratic National Committee of $5000. What a coincidence!

Fokker said under oath that he had only one contract for selling American planes abroad—and that one contract was with Elliott Roosevelt for the sale of fifty military conversion type Lockheed *Electras* to the Soviet Union at what Tony considered an exhorbitant figure but which he supposed the President's son could handle through his influence with the Import-Export Bank officials named by his father.

Elliott concluded: "A copy of the contract is in the possession of Charles Michelson, Publicity Director of the Democratic National Committee. Mr. Michelson is free to release those parts of it refuting the Fokker charges, and as soon as I consult with my attorneys it is probable I will release the entire text of the contract." That was on October 7th. It is now near the end of October and the contract is yet to be released either by Michelson or Roosevelt and it never will be, because there is no contract other than the one in our possession.

There's no question but that the Nye Committee suppressed a sworn statement by Fokker covering this transaction.

As far back as January, 1935, the late Huey P. Long was asking questions of Senator Nye which it is believed now referred to the Roosevelt-Fokker deal. I quote from the Congressional Record, 74th Congress, Vol. 79, Page 459:

"Mr. Long: I just want to know from the Senator from North Dakota if there is any disposition on the part of anybody to stop this investigation . . . that the water is getting hot around here for some people, and they are trying to sidetrack the investigation. . . . It looked to me as if the committee were getting right close to home on some of them. I did not know but that maybe there is a little squall being raised that the Senate ought to stop this thing and do something before the committee gets right to the point where these devils will be really found out. Has there been any disposition to stop this investigation?"

"Mr. Nye: I want to say to the Senator that if there is any such disposition there certainly has not been evidence of it in any such shape or form as would enable me to say that there is one soul in the Senate who does not want the investigation to go on."

Said Mr. Lewis—"The Senator from North Dakota stated, in reply to the Senator from Louisiana, that he was quite confident there was no one in this body (meaning the Senate) who was making any effort to terminate the investigation. I am sure the learned Senator did not mean to indicate that in the War Department or the administrative or any other branch of the Government there was such effort; did he?"

"Mr. Nye: Mr. President, I am going to have to decline to answer the question which I know the Senator very respectfully submits. I cannot answer the question without possibly doing grave injustice to men who are not deserving of that sort of attitude at all."

"Mr. Long: Mr. President, does the Senator mean 'justice' or 'injustice'?"

And again when Senate convened on January 30, 1936, the Nye Committee had made public proceedings that smeared the good names of Woodrow Wilson and Robert Lansing. It was known that a resolution providing another appropriation for the Nye Committee which had run out of funds was coming up. Senator Connally of Texas took the floor and assailed the Nye Committee for exceeding its authority with a batch of correspondence and in words which sizzled. He questioned the conduct and even the integrity of his colleague in this matter. The complete drama of that session is to be found in the Congressional Record for January 30, 1936, beginning on Page 1261. "I see by the newspapers that there are great secrets which are going to be revealed if they do not get the money" said Connally. "Nye vows new war secrets"—that is the headline. Another headline "Nye threatens to reveal all" "Going to reveal everything" "Going to reveal all" "Let the Senator reveal all" "What is it that is being hidden from the country." The headline continues "Says he will air Soviet recognition deal if inquiry funds are stopped" "Let him reveal all" Connally challenged. On the date of this sensational discussion (January 15, 1936) the Nye Committee had in its possession the Fokker affidavit telling of the contract with Elliott Roosevelt for this affidavit was made "in the presence of Stephen Raushenbush and Joel Earnest, Nye Committee investigators, on Thursday, September 12, 1935.

And on October 5, 1936, Nye made the following statement to a reporter from the New York *Sun:* "the matter was before our committee but never in any such detail as appears in this published article (referring to Aero Digest's story). We were prevented from following through and developing the rather limited information that we had by reason of our budget but I do insist that if the information in its present published form and detail had been before the committee there would have been an insistence upon the hearing and recording of the facts."

At this time the Nye Munitions Committee had a copy of the contract and complete Fokker files in their possession.

In addition, Aero Digest charged that Elliott Roosevelt had attempted in concert with Fokker and Herbert A. Reed under a "gentlemen's agreement" incident to that employment contract to snatch the air mail contracts on the major airlines of the nation as soon as "Father" through Jobmaster Jim Farley had cancelled the old mail carrying agreements—which action resulted in the deaths of twelve Army Air Corps pilots ordered to fly mail routes by their Commander-in-Chief, the President.

This air mail thing was decidedly too hot—and too many innocent taxpayers were too hot over income-tax pressures for any of the incumbent crew to breathe a word on either subject.

What President Roosevelt, his son Elliott, Senator Nye and others of those who have been doing as they pleased with one thing or another since March of 1933 fail to remember is—that regardless of what happens November 3, Franklin Delano Roosevelt will not always be President; the strong Democratic-Republican "New Deal" bloc will not always have control of the Senate; a just, honest administration can appoint Congressional committees to go into all these matters with better grace than has been exercised by most of the "New Deal" crop of probers.

And when they do—

Well, some of the warmest of the New Deal henchmen may find the air far too hot in Washington.

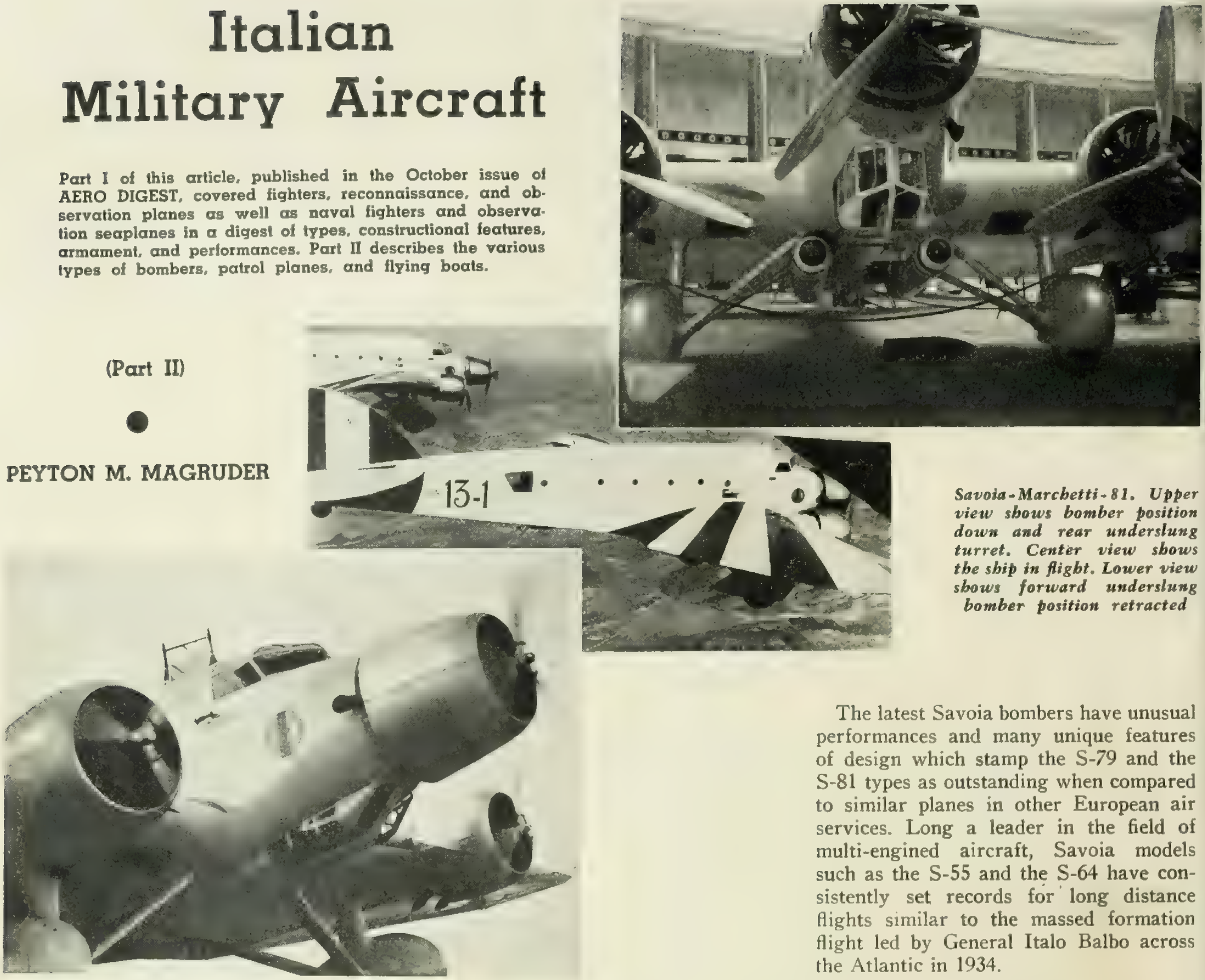
Italian Military Aircraft

Part I of this article, published in the October issue of AERO DIGEST, covered fighters, reconnaissance, and observation planes as well as naval fighters and observation seaplanes in a digest of types, constructional features, armament, and performances. Part II describes the various types of bombers, patrol planes, and flying boats.

(Part II)

●

PEYTON M. MAGRUDER



Savoia-Marchetti-81. Upper view shows bomber position down and rear underslung turret. Center view shows the ship in flight. Lower view shows forward underslung bomber position retracted

● As pointed out in Part I, the Italian air force is being expanded considerably by Il Ducé in an effort to gain military and naval supremacy in the Mediterranean area. A large portion of this expansion has been necessarily in the heavy bomber category with a number of types creating widespread publicity in the Ethiopian campaign and in the present Spanish Revolution. Well-informed observers estimate that no less than 1500 bombers will be built during 1936 with present production plans calling for a slight increase in 1937. Delivery of long range flying and reconnaissance boats is keeping pace, on a smaller scale, with the larger land type bombers.

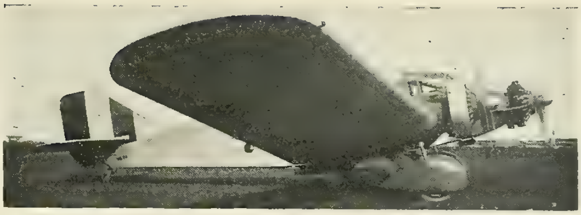
Italian bombers are almost exclusively of Caproni or Savoia-Marchetti manufacture as these companies are building eight of the ten types now in active use by the *Regia Aeronautica.* The same situation is apparent in the flying boat or patrol plane category with more than half of these types being of Caproni or Savoia-Marchetti design. The Piaggio plant is turning out rush orders for the P-16 monoplane bomber and is supplying Mediterranean squadrons with a new single-float seaplane about which little has been published. The Savoia S-55 twin-hulled flying boats which have an unusually long cruising range and a top speed of 147 mph are being placed in service at coastal air stations in increasing numbers.

Both Caproni and Savoia-Marchetti bombers were extensively employed in Ethiopia. The Ca 101 and Ca 111 types were first used, but it was found that the extreme ranges required for safe operation over the dangerous Ethiopian terrain necessitated newer models having longer cruising radii. As a result, towards the end of the campaign, the Savoia-Marchetti S-79, S-81, and Piaggio P-16 types were shipped to Africa in large quantities, along with a few of the Breda 46 models which proved to be more successful and of much greater military value than the earlier Caproni bombers which were more or less obsolete due to their low ceilings and relatively short ranges.

The latest Savoia bombers have unusual performances and many unique features of design which stamp the S-79 and the S-81 types as outstanding when compared to similar planes in other European air services. Long a leader in the field of multi-engined aircraft, Savoia models such as the S-55 and the S-64 have consistently set records for long distance flights similar to the massed formation flight led by General Italo Balbo across the Atlantic in 1934.

Bombers

The Breda 46, a low wing, all-metal type, is equipped with three Alfa-Romeo *Pegasus* nine-cylinder radial engines of 700 hp each. The cantilever wing consists of a single square-section box-spar, to which attach front and rear cantilever ribs, the whole being dural covered. Fuselage is of rectangular all-metal structure with the fuel tanks placed in the main wing spar. Accommodations for pilot and co-pilot, radio operator, and gunner-bomber are similar to the standard arrangement used for Italian heavy bombers, in which the pilot and co-pilot are seated side-by-side. Immediately aft is the radio operator's compartment and a cabin which can accommodate 12 troops. Aft of this is the machine gun emplacement having positions for the gunner both above and below the fuselage. The radio operator has two emergency gun positions, one above, and the other below the fuselage, each equipped with either 7.7 mm or 12.7 mm Breda-Safat machine guns. A normal bomb load of 2200 lbs. placed vertically in the inner sides of



The Breda 46 has a speed of 196 miles per hr.

the fuselage is also provided. The *Pegasus* engines give a maximum speed of 196 mph, service ceiling of 25,400 ft., and range of 1,240 miles. Gross weight is 20,460 lbs., and empty weight, 12,100 lbs.

The oldest type Caproni still on the active list is the single or three-engined Ca 97 monoplane which can be used for a variety of purposes such as a light reconnaissance, light bomber, transport, or ambulance type. Of typical high wing Caproni design, its lines are similar to those of the Ca 101, Ca 111, or Ca 133, which are all simply larger designs with slight modifications and refinements such as welded instead of riveted tubular fuselages, and more powerful engines. When equipped for reconnaissance work, three machine guns are mounted—one firing forward through the propeller disc; another, down through the cabin floor; and the third, in a flexible mount directly aft of the wing and above the fuselage. The cabin, capable of holding five men, has bomb racks in the floor and sides and may be arranged to take three stretchers and one attendant for ambulance work. Either three 130 hp Lorraine five-cylinder radial engines or one 500 hp *Jupiter* may be used. The latter gives best performance with a 143 mph top speed. A range of 500 miles and a ceiling of 21,320 ft. may be attained with a gross weight of 5500 lbs.

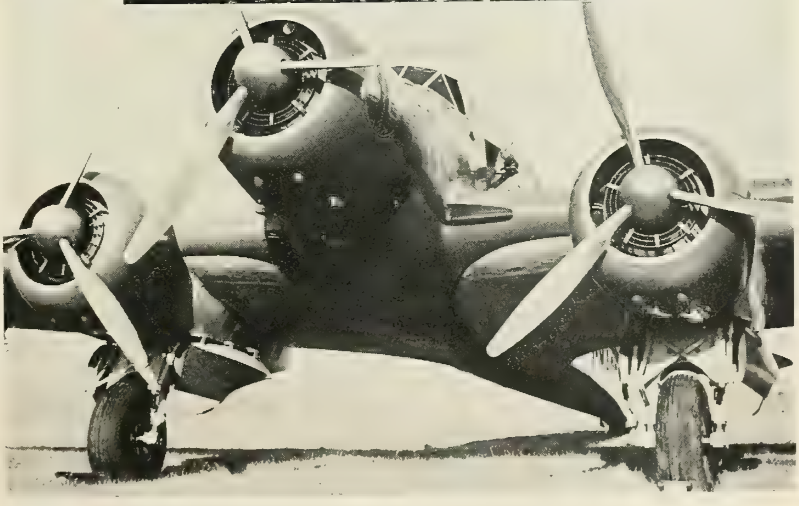
The Caproni Ca 101 *Colonial,* a larger version of the Ca 97, has three 270 hp Alfa *Dux* radial engines which give it a top speed of 130 mph. Equipment includes light bomb racks, two stretchers, and complete radio and photographic apparatus in addition to three machine guns—one, in a retractable turret above the fuselage and aft of the wing, and two, firing downwards through the fuselage floor. A range of 620 miles is obtained with a gross weight of 9020 lbs. The Ca 101 *Bomber* is a heavier version of the *Colonial* and forms the equipment of several night bombing squadrons. Three 370 hp *Stella VII* engines give a 155 mph maximum speed, service ceiling of 19,680 ft. and a range of 600 miles. Fully loaded the *Bomber* weighs 11,317 lbs., of which 3740 lbs. is useful load.

Another version of the Ca 101 is the Caproni 111, a long distance reconnaissance or light bomber. Fabric-covered wooden wings and a welded steel-tube fuselage and tail are the only differences between the Ca 111 and the Ca 101, excepting that the Ca 111 is larger. An 850 hp Isotta-Fraschini engine gives a maximum speed of 180 mph, a range of 807 miles, and a 21,976 ft. ceiling. Fully loaded the Ca 111 weighs 12,100 lbs. and carries a useful load of almost 4400 lbs.

The latest of the line of Caproni bombers is the Ca 133, a tri-motored, high wing monoplane, suitable for either civil or military use. Structurally, the 133 is similar to the 101 with the same wing arrangement except for the addition of flaps and aerodynamically-balanced ailerons. The oval welded steel tube fuselage forward is covered partially with sheet dural and aft with fabric. A cabin seating 16 may be arranged for colonial military equipment or for general purpose use. Three-bladed adjustable (on the ground) metal propellers driven by three 430 hp *Stella VII* supercharged engines give a maximum speed of 162 mph at 13,120 ft. With a gross weight of 14,080 lbs. including a useful load of 5500 lbs., maximum ceiling is 21,320 ft. and range 838 miles.

One of the newest bombers to go into quantity production is the three-engined mid-wing Piaggio P-16. Equipped with retractable landing gear, which folds backwards into the engine nacelles, and cantilever wings and tail unit, the P-16 has a maximum speed of 248 mph. Fuselage is of oval section with a fabric-covered welded tube framework. Flaps are synchronized with the ailerons and both are placed on the outer wing panels which taper in chord and thickness. An unusual feature of the engine nacelles are sliding doors which close the aperture when the wheels are retracted. Directly aft of the nose engine is the pilot's position with a dual control side-by-side seating arrangement. Below the wings is the bomb compartment with bomb sights and releases amidships. Aft are two gun positions in enclosed turrets. Three 700 hp Piaggio *Stella IX R.C.* nine-cylinder radial supercharged engines give a range of 1242 miles with 1100 lbs. of bombs and a fully loaded weight of 18,590 lbs.

The S-72, one of the standard heavy bombers with which many squadrons of the *Regia Aeronautica* are equipped, is a three-engined high wing cantilever monoplane type utilizing 550 hp *Pegasus* radial engines. Tapering in chord and thickness the single-piece wooden three-spar wing is attached to the top of the fuselage which is of welded steel tubing. The two main fuel tanks are in the streamlined engine nacelles and are quickly detachable during flight. Positions of the crew are identical to those of other similar three-engined Italian bombers with turrets aft, above and below the fuselage. A forward emplacement mounts one machine-gun which fires directly down-



Tri-motored Savoia-Marchetti S-79 bomber with retractable landing gear

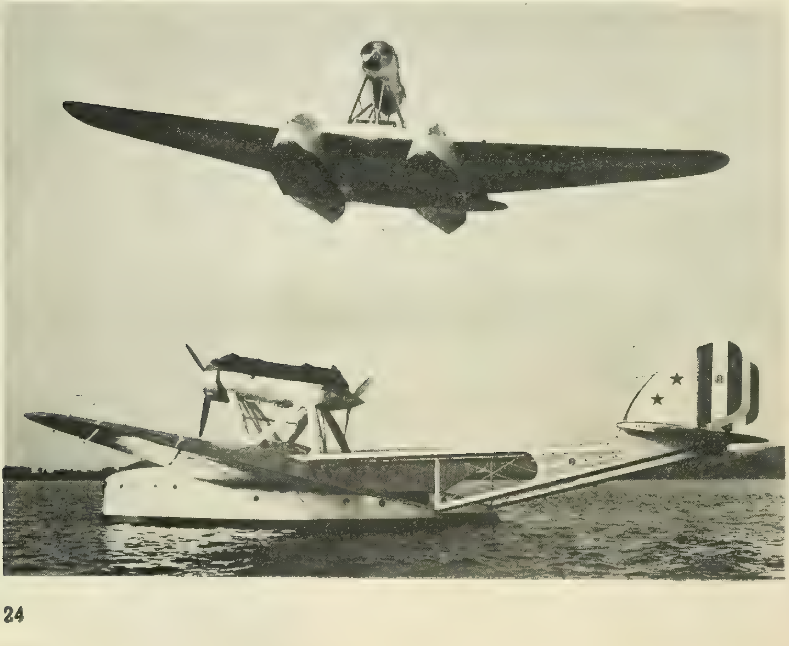
Four-motored S-74 (left) and the tri-motored Caproni 133 bomber

ward below the pilot's compartment. A maximum useful load of 13,200 lbs. provides for 4500 lbs. of bombs and a cruising range in excess of 1000 miles. Fully loaded the S-72 achieves a maximum speed of 183 mph at 13,120 ft. and, with flaps, lands at 59 mph.

The fastest bomber in service in Italy today is the tri-motored S-79 which has a reputed top speed of 267 mph when equipped with 820 hp Alfa-Romeo 125 R.C. radial engines. Structure of the one-piece fabric-covered cantilever wing consists of three double "T" section spars, solid plywood compression and former ribs, and a plywood skin. Internally, the wing structure is sub-divided into a number of water-tight compartments. Ailerons are statically balanced, with Handley-Page slots and flaps located inboard. Welded chrome molybdenum steel tube framework covered with fabric is utilized for both fuselage and tail unit. The retractable type landing gear folds backwards into the engine nacelles, the openings being closed by sliding panels as in the Piaggio P-16. Engines are NACA cowled and are on welded chrome-moly tube mountings. Three-bladed hydraulically controlled variable pitch propellers are employed in obtaining a maximum rate of climb in excess of 1200 ft./min. Gun crews are located in standard positions with retractable turrets, each mounting twin 7.7 mm machine guns, above and below the fuselage aft of the wings. Maximum range is 1000 miles with 4400 lbs. of bombs stowed internally. With a fully loaded weight of 16,000 lbs., the maximum ceiling is 26,000 ft. on three engines, and 7,500 ft. with one engine.

The S-81, latest Savoia heavy bomber to go into quantity production, is a larger modification of the S-79 having three 900 hp Gnôme-Rhône 14 cylinder radial engines. Structural features are essentially the same as those of its prototype, except that a partially retractable bomb position is provided forward of and below the pilot's compartment. A normal crew of four is carried in the usual positions. The upper gun emplacement directly aft of the pilot's position has a twin gun retractable turret similar to those on the S-79. Aft, another retractable turret provides for gunfire directly downward below the fuselage. Due to the fixed landing gear and increased size and weight, top speed is 217 mph, however, 4400 lbs. of bombs are carried in addition to complete photographic equipment. Estimated range is 1500 miles with full bomb load and a gross weight of 20,000 lbs.

Twin-motored S-55 patrol boats



PRINCIPAL ITALIAN MILITARY AIRPLANES

	Total hp	Gross Weight (Lbs.)	Max. Speed (mph)
BOMBERS			
Breda 46	2100	20,460	196
Caproni 97	500	5,500	143
Caproni 101—Colonial	810	9,020	130
Caproni 101—Bomber	1110	11,317	155
Caproni 111	830/970	12,100	180
Caproni 133	1290	14,080	162
Piaggio P-16	2100	18,590	248
Savoia-Marchetti S-72	1650	28,160	183
Savoia-Marchetti S-79	2460	16,000	267
Savoia-Marchetti S-81	2700	20,000	217
PATROL PLANES AND FLYING BOATS			
Cant Z. 501	850	12,100	162
Caproni 97—Hydro	500	6,270	137
Caproni 111—Hydro	850	12,540	174
Macchi M. C. 77	750	10 560	160
Savoia-Marchetti S-55	1400	16,940	147

Patrol Planes and Flying Boats

The outstanding flying boat in service in the Italian Navy is the Cant Z.501, a four-place light bomber and reconnaissance or patrol type. Designed by Signor Zappata, who first gained prominence while with the French Blèriot company, the Z.501, in July, 1935, set a world's record by flying non-stop from Monfalcone, Italy, to Berbera, British Somaliland, a distance of 3080 miles. A high wing braced monoplane, the Z.501 is of wood structure with a semi-circular two-step hull. The wing is in three sections, with outer panels attached to the central engine nacelle and heavily braced to the hull by parallel struts. A cockpit is placed in the bow of the hull with bottom openings (for cameras) which are covered by a water-tight door. Directly in front of the wings is placed the side-by-side dual control pilots' cockpit and farther aft, just below the trailing edge, is the gunner's position protected by a semi-enclosed cockpit. Behind the cockpit and inside the hull is the bomber position with sliding ports in the starboard side of the hull. Above, in the engine nacelle and over the center of the wing, is a third gun position protected by a semi-circular windshield. This unusually placed machine gunner has an extremely wide angle of fire. An 850 hp Isotta-Fraschini *Asso*-750 18-cylinder water-cooled geared engine, placed in the nacelle in the wing above the hull, gives a top speed of 162 mph and a range greater than 3000 miles with a gross weight of 12,100 lbs.

A light bomber or reconnaissance type is the Caproni 97-*Hydro*, which is now practically obsolete. Similar in every respect to the Ca 97 single engined military monoplane (except for the twin dural floats), the 97-*Hydro*, when fitted with a 500 hp *Jupiter* geared engine, has

(*Continued on page* 86)

Physiological Requirements of High Altitude Aircraft Compartments

●

HARRY G. ARMSTRONG, Capt., Medical Corps,

Director, Physiological Research Lab., Materiel Div., Air Corps.

● While the development of sealed high-altitude compartments and their accessories is strictly an engineering problem, it is important to remember that the necessity for this type of compartment arises solely from physiological considerations. It must, therefore, be obvious that the only intelligent approach to the subject is through a clear understanding of physiological requirements. For the past several months at the U. S. Army Air Corps, Materiel Division, a study has been in progress covering all phases of sealed high-altitude aircraft and this report constitutes a component part of that study.

The principal physiological requirements to be considered are: oxygen; the carbon dioxide problem; carbon monoxide and other noxious gases; temperature regulation; humidity control; ventilation; noise levels; and barometric pressure considerations.

Oxygen Requirements

Oxygen is the most vital of the bodily requirements, for death (unless one is burned alive) is always ultimately due to lack of oxygen in the body cells. Only 400 cc. of oxygen, sufficient for about 50 to 60 seconds, is normally carried in reserve. Therefore, man must have a constant supply of oxygen available at all times to sustain life. It is this factor, more than any other from the standpoint of personnel, that has made flight at high altitude difficult and in many cases impossible. To properly understand the oxygen requirements of sealed high altitude compartments, it is necessary to understand the physiology of respiration and the relation of high altitudes to anoxemia (oxygen-want).

Sealed compartments today seem to offer the only logical solution to the personnel problem of sustained flight at high altitude. Most of the best qualified leaders in the aircraft industry agree that the idea is entirely practical and many are proceeding with research in this field.

Normal atmosphere contains at all known altitudes approximately 79+% nitrogen, 21.93% oxygen, .03% carbon dioxide, and small traces of other inert gases. During respiration, this atmospheric air is taken into the lungs where a part of the oxygen is taken up by the blood and carbon dioxide is given off by the blood to the lungs such that the expired air contains 17% oxygen and 4.38% carbon dioxide.

It was first shown experimentally by Paul Bert, and since confirmed by many others, that the supply of oxygen that passes from the lungs to the blood depends directly upon the partial pressure of the oxygen present and not upon its percentage. It is for this reason that when man ascends to high altitudes, where the barometric pressure and consequently the oxygen partial pressure is less, that he suffers from anoxemia, even though the oxygen percentage is the same as it was at sea level. To a person acclimated to sea level conditions, an ascent to only about 4,000 to 5,000 ft. is necessary before the blood begins to get less than its normal load of oxygen from the lungs. As ascent continues, less and less oxygen is carried to the body cells and, if continued far enough, they finally die—usually at about 24,000 to 30,000 ft.

Since oxygen follows Dalton's law of gases, it exerts the same pressure that it would if it occupied the whole space alone. Therefore, oxygen at high altitudes may be brought to sea level partial pressures by compressing the atmosphere; by increasing the oxygen percentage or by a combination of the first two methods.

Thus it is evident that there are three possible types of sealed high altitude compartments. For the first type which depends upon pressure for its effectiveness, the term "pressure compartment" is suggested. This may be defined as "any sealed aircraft enclosure designed to furnish adequate *available* oxygen to contained personnel at high altitude by increasing the partial pressure of oxygen in the compartment through an increase of pressure of the contained or introduced atmosphere." The term "oxygen compartment" is suggested for the second type of sealed high altitude compartment. This may be defined as "any sealed aircraft enclosure designed to furnish adequate *available* oxygen to contained personnel at high altitudes by increasing the partial pressure of the oxygen in the compartment through an increase of the oxygen percentage of the contained or introduced atmosphere." For the third type which is a combination of the other two, the term "oxygen-pressure compartment" is suggested. This may be defined as "any sealed aircraft enclosure designed to furnish adequate *available* oxygen to contained personnel at high altitudes by increasing the partial pressure of the oxygen in the compartment through an increase of both pressure and oxygen percentage of the contained or introduced atmosphere."

In the above definitions the term compartment is inclusive, covering all enclosures for personnel, and allows for a specific designation of special types such

D. W. Tomlinson, of Transcontinental & Western Air, Inc., prepared for high altitude research in TWA's new laboratory plane

Personnel Activity	Compartment Pressures (Lb.per sq.in.absolute)			
	14.7	11.0	9.7	8.0
Rest (in bed)	2.39	2.86	3.46	4.23
Rest (standing)	3.31	3.97	4.81	5.86
Walking (2 m.p.h.)	7.87	9.43	11.40	13.90
Walking (3 m.p.h.)	10.80	12.90	15.60	19.00
Walking (4 m.p.h.)	16.10	19.30	23.30	28.50
Walking (5 m.p.h.)	25.70	30.90	37.30	45.50

Table I. Ventilation rates to supply minimum oxygen required

Altitude in feet	Oxygen per cent
0	20.93
5,000	25.20
10,000	30.40
15,000	37.10
20,000	45.60
25,000	56.40
30,000	70.50
35,000	89.00
37,500	100.00

Table II. Oxygen percentages vs altitudes

Personnel activity	Cu. ft.
Rest (in bed)	.417
Rest (standing)	.559
Walking (2 m.p.h.)	1.403
Walking (3 m.p.h.)	1.954
Walking (4 m.p.h.)	2.966
Walking (5 m.p.h.)	5.06
Heavy labor	10.12

Table III. Volume of carbon dioxide exhaled per hour

Per cent carbon dioxide	Lung ventilation rates
.03	100
1.74	143
2.07	153
3.80	258
5.28	447
6.66	622
7.66	795

Table IV. Effect of carbon dioxide concentrations

as "pressure cockpits," "oxygen cabins," etc. It is to be noted that mechanical terms have been avoided as being of incidental rather than fundamental importance. For example, should the current term "supercharged cabin" be adopted, it would not permit of a uniform terminology for the other two types and, should other compression mechanisms be employed (which is entirely possible), it would then become a misnomer. Furthermore, it is entirely practicable to designate different mechanical types, if necessary, by simply adding the proper prefix to the above terms, such as "supercharged pressure compartment," "liquid air pressure compartment," etc.

James Heistand, development engineer and observer in TWA's laboratory plane

Since the partial pressure of oxygen at sea level is 159 mm. Hg. (21% of 760 mm. Hg.) all high altitude compartments should provide sufficient oxygen at or near that partial pressure during flight.

In pressure compartments, this means that the pressure must be maintained at about 12 to 14.7 lbs./sq. in. abs. Also, since the oxygen in the compartment is being constantly consumed by the personnel, there must be a steady constant flow of fresh air to replace it. The rate of flow required varies with the activity of the personnel and the minimum in cu. ft./hr./person is shown in Table I.

Oxygen compartments maintain the pressure of the surrounding atmosphere at all altitudes and the partial pressure of the oxygen in the contained atmosphere may be kept at or near 159 mm. Hg. by enriching the contained air from any auxiliary oxygen supply. This serves not only to increase the oxygen percentage but also replaces that consumed. Here a free flow of air through a compartment is not only unnecessary but undesirable as this would soon dissipate the oxygen supply. The compartment percentages required to give 159 mm. Hg. oxygen partial pressure at various altitudes is shown in Table II.

It is to be noted from this table that when an altitude of 37,500 ft. is reached, 100% oxygen is required to give an oxygen partial pressure of 159 mm. Hg and that this partial pressure cannot be further increased by this method and hence is the critical ceiling of this compartment. Any altitude beyond that is at the expense of anoxemia among the personnel, whose absolute ceiling under these conditions is probably from 44,000 to 47,000 ft.

In oxygen-pressure compartments, the oxygen partial pressure may be maintained at or near 159 mm. Hg. by countless combinations of increased pressure and oxygen percentages. As far as the oxygen supply to personnel is concerned, there is little choice in the pressure-oxygen percentage combinations used but, for mechanical reasons at extreme altitudes, it allows the use of relatively low compartment pressures with high oxygen partial pressures. Here, as in oxygen compartments, no free ventilation is permissible due to the waste of oxygen.

The Carbon Dioxide Problem

Carbon dioxide is a gas at ordinary temperatures and pressures. It is a waste product of body metabolism and exists in the normal atmosphere to the extent of .03%. Under normal conditions, air containing .03% of carbon dioxide is inhaled into the lungs, part of the oxygen is removed by the blood and carbon dioxide is given off such that the exhaled air contains about 4.38% carbon dioxide. The amount of carbon dioxide given off in a given period of time amounts to 4.38% of the volume of air exhaled which, in turn, depends on body activity, as shown in Table III.

While .03% carbon dioxide is the normal amount found in ordinary atmospheric air, it has been shown that this can be markedly increased without harmful effect. As a matter of fact, an in-

The late Wiley Post, one of the pioneers in high altitude test flying crease of carbon dioxide in the inspired air during periods of oxygen-want (for example, at altitudes of 6,000 to 12,000 ft.) helps to overcome the effects of the oxygen-want by increasing the lung ventilation, because it is an accumulation of the carbon dioxide content in the blood and not oxygen-want that is the controlling factor in respiratory volume. Thus it has been found that increasing the carbon dioxide percentage of the inspired air has a stimulating effect on lung ventilation as shown in Table IV.

From this, it can be seen that a compartment carbon dioxide content of 1.0% to 2.0% is not harmful and, if a relative cabin altitude of above 5,000 feet is used, it becomes beneficial.

Another factor which is of considerable interest is that with pressure compartments the ventilation rate will be governed, not by the oxygen requirement, but by the carbon dioxide accumulation, since the latter requires the higher rate of air exchange. The ventilation rate required to keep the carbon dioxide percentage constant is shown in Table V. The percentages indicated are for cu. ft./hr./person.

For oxygen compartments, the carbon dioxide will require absorption by chemicals through an air conditioning apparatus with an internal circulation of the compartment air.

As far as can be determined, there is at present no simple indicator available for recording the carbon dioxide composition of air. Such an instrument is urgently needed.

Oxygen-pressure compartments like oxygen compartments require the absorption of carbon dioxide by means of chemicals.

Carbon Monoxide and Other Noxious Gases

Noxious gases are divided into four classes depending upon their action on the human organism:

Asphyxiants: Physiologically inert gases, like nitrogen, which when breathed in high concentrations act mechanically by excluding oxygen.

Irritants: These injure the air passages and lungs and induce inflammation on the surface of the respiratory tract.

Volatile Drugs and Drug-like Substances: These gases exert little or no effect on the lungs but act after they have been absorbed into the blood, affecting chiefly the nervous system and induce anasthesia.

Inorganic and Organometallic Substances: A large group of poisonous elements and compounds in volatile form exerting a wide variety of toxic actions after their absorption into the body.

In sealed compartments, it is especially important that all noxious gases be excluded and care taken that none are generated within the compartments. This is particularly true in oxygen and oxygen-pressure compartments where no through ventilation is provided. The question of cooking fumes, chemical toilets, emanations and others must here be given close attention.

By far the most important noxious gas with which we have to contend is carbon monoxide. The danger from carbon monoxide poisoning in sealed aircraft compartments is probably best stated by saying that the chances of poisoning are less than in the conventional type of airplane but in the event of poisoning the danger is greater. This is due to the fact that a sealed compartment will protect against many of the present accidental poisonings from engine exhaust gases but should carbon monoxide get into a sealed compartment, its effect would probably be greater.

The principal dangers of carbon monoxide poisoning in pressure compartments is from exhaust type superchargers, air supply derived from carbon monoxide contaminated sources, and from defective exhaust type heaters.

In oxygen compartments, the dangers of carbon monoxide poisoning arise from exhaust type heaters and also from the fact that in descent, atmospheric air will be drawn into the cabin and, if the intake valve is located in a carbon monoxide contaminated position, carbon monoxide will also be drawn in.

Temperature Regulation

The ideal temperature for any human habitation with personnel at comparative rest is 68°F. However, a temperature of 50° to 75° is compatible with health and comfort. Temperatures above 75° in a closed space soon become uncomfortable and tend to lower both physical and mental efficiency by inducing bodily depression, sleepiness and fatigue. Temperatures above 110°F. are intolerable.

The temperatures below 50°F. may be divided into the range 50°F. to 20°F. through which the average individual can keep warm by suitable clothing; the range 20° to —40°F. through which cold can be borne only with great discomfort, and below —40°F. which almost always produces actual physical damage ranging from local frost bites to death.

Sudden changes of temperature are undesirable as they tend to produce sweating or chilling which results in discomfort and may endanger health. In calculating the temperature regulation of any high-altitude compartment, it is to be remembered that the temperature of the surrounding atmosphere may range from that present on the ground to that of the stratosphere (120 to —67°F.) and that the introduced atmosphere may range from 300°F. (from engine supercharger) to —295°F. (liquid oxygen).

Humidity Control

The humidity of high-altitude compartments is important from two standpoints. For personnel comfort and health, the relative humidity should be from 45% to 50%; however, a range of 25% to 75% is tolerated without producing serious results. A relative humidity above 75% produces an oppressive atmosphere with lowered efficiency, while below 25% dries the air passages and predisposes to acute respiratory disease.

For mechanical reasons, the relative humidity should be low enough to prevent frosting of windows and this is said to be 35% or below for single windows and 45% or below for double windows (storm type with air space).

In the control of compartment humidity it must be remembered that moisture from the skin and lungs of the average individual at rest without visible sweating amounts to 1½ oz./hr., which is sufficient to saturate 82 cu. ft. of air at 70°F. from 0% to 100%. Under unfavorable conditions of activity or high temperature there may be an increase of as much as three or four times this amount of moisture produced. In any event, it is believed that to properly control humidity in all three types of compartments, the interiors will require air conditioning with the absorption of water vapor by chemicals.

Ventilation

Ventilation is defined as "supplying fresh air." In a broader sense it refers to a circulation of air with the introduction of fresh clean air and the removal of accumulated carbon dioxide. For our purposes, we must not only think of ventilation through a compartment but also within a compartment.

Contrary to general opinion, while it is desirable, ventilation is not absolutely necessary if sufficient fresh oxygen is supplied and carbon dioxide removed by other means. The belief that there is a mysterious poisonous emanation from the

Personnel activity	Compartment carbon dioxide concentrations					
	.25	.50	1.0	2.0	3.0	5.0
Rest (in bed)	189.0	83.0	43.0	22.2	14.0	8.3
Walking (2 m.p.h.)	638.0	299.0	145.0	71.0	47.0	28.0
Walking (5 m.p.h.)	2300.0	1077.0	522.0	257.0	170.0	102.0

Table V. Ventilation rate needed to keep carbon dioxide % constant

body or breath has been definitely disproved. There is, however, an odoriferous emanation from the body which clings to the interior of a closed space and is noticeable especially upon first entering and while this is disagreeable, it is not harmful. It is obvious, therefore, that ventilation *per se* is not absolutely necessary—but highly desirable—especially to accomplish other requirements and these are discussed under their respective headings.

In oxygen and oxygen-pressure compartments an interior circulation must be maintained to diffuse the oxygen, pass the exhaled carbon dioxide over chemicals for its elimination, and reduce the humidity of the air by chemical absorption. This can be accomplished by a small air conditioning unit containing a fan and the proper chemical absorbents, all of which are readily available on the market.

Noise Levels

The question of noise control in oxygen compartments is no different than that of the conventional airplane. In pressure compartments, and oxygen-pressure compartments on the other hand, a new factor, which must be overcome, is introduced. This new factor is the noise created by the introduction of compressed air into the compartment and its escape through the relief valve. Both produce an intense and most disagreeable sound. For all three types of compartments, the noise level should be kept below 70 db.

Barometric Pressure Considerations

Assuming that the pressures in compartments are kept equal to one atmosphere or less, the effects of barometric pressure changes to be considered are due to only one of two factors: first, is the degree of change and second, the rate of change.

A slow rate of change of barometric pressure up to 47 mm. Hg. pressure is, as far as is known, harmless. At less than 47 mm. Hg. pressure the fluids of the body would theoretically boil and the results would be fatal. Likewise, while it has never been definitely demonstrated, it is possible that "bends" or "caisson" disease might develop during rapid changes of decreased barometric pressures due to the evolution of nitrogen gas bubbles forming in the blood.

The rate of change of barometric pressure, on the other hand, has a more definitely known if less serious effect. A rapid rise or fall of barometric pressure tends to create a partial vacuum or pressure in the middle ear and sinuses which, if not relieved, produces marked discomfort or actual pain and in the case of the ear may cause rupture of the ear drum.

A rapid increase of pressure may drive infected materials into the middle ear or the nasal accessory sinuses and set up inflammatory processes. A rapid decrease in pressure may distend the abdomen with a resultant expansion of the contained gases which causes discomfort and pain and may cause crowding of the heart and lungs which seriously embarrasses their action. Just what rate of increased or decreased pressure can be tolerated varies with individuals but may be set at about 200 ft./min. for the average. It must be remembered that no change is highly desirable and this is one of the advantages of pressure compartments over oxygen and oxygen-pressure compartments.

Summary and Conclusions

It may be concluded that the fundamental physiological requirements of sealed high altitude compartments are of a practicable nature and also that sealed compartments at the present state of our knowledge offer the best solution to the problem of maintaining personnel during flight at high altitudes.

SOME METHODS USED IN THE STATIC TESTING OF AIRCRAFT STRUCTURES

EDWIN W. WALKER
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● The methods and results outlined in this article were successful in meeting the rigorous specifications of the Bureau of Aeronautics, U. S. Navy, and unquestionably these methods would also meet the Dept. of Commerce test requirements.

When no recourse is had to a rib testing machine the sketches show how a simple and inexpensive wooden structure with wooden lever arms and pans filled with lead shot can be built. Tail surfaces and rear of the fuselage can best be tested on two 10-in. deep steel I beams, although two 4 × 12 ash beams would be just as satisfactory. Other necessities are 3000 or 4000 lbs. of lead shot in bags of 5, 10, and 20 lbs. each. Pig irons can be used for loading if they are carefully

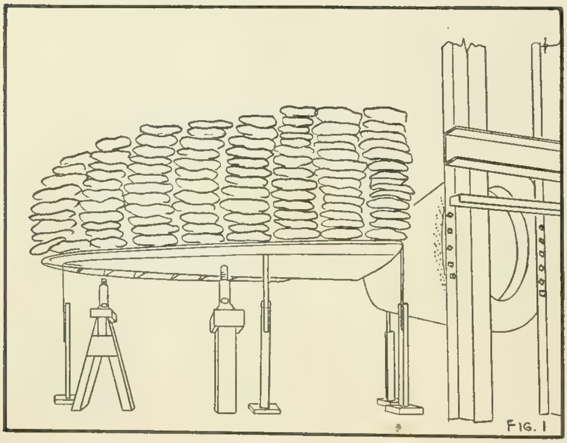


Fig. 1

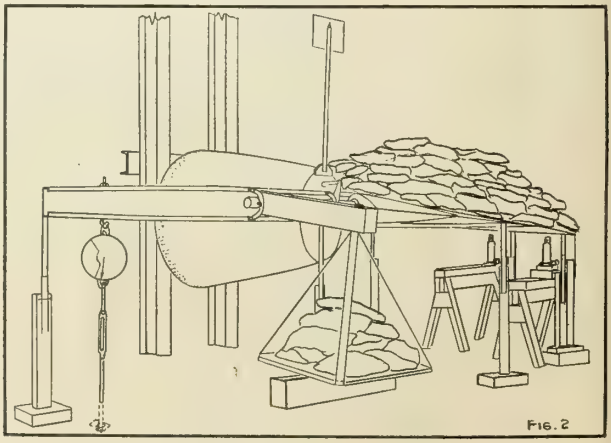


Fig. 2

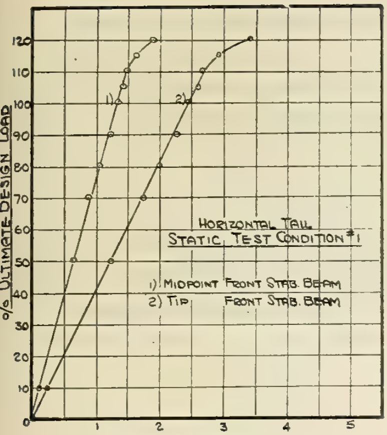


FIG 3

interspaced with sand bags so that they will stay in position. Pig irons and sand bags are less expensive as to initial cost, but may cost more over a period of time due to the fact that it takes longer to handle them to obtain the required load distribution. Two or three automobile jacks are also necessary for applying the loads.

The procedure for testing the stabilizer and elevator was as follows:

First a loading schedule was determined for the two test conditions required. Condition 1 distribution of loads gives approximately a triangular distribution in a chordwise direction with a maximum over the leading edge of the stabilizer and no load on the elevator. Condition 2 gives a uniform load over the stabilizer and triangular distribution over the elevator. Condition 1 is critical for the leading edge and front beam of the stabilizer and Condition 2 is generally critical for the elevator and rear beam of the stabilizer. The actual calculation of these loads is part of the stress analysis procedure and will not be explained in detail in this article. The loads are based on the actual loads for a given angular acceleration to overcome pitching moments when pulling out of a dive and are obtained from wind tunnel tests of the model.

The loading increments of area were marked out on a thin piece of plywood cut to the contour of the stabilizer and elevator. Then 5, 10, and 15 lb. sand bags interspaced with pig iron weights of 25 to 90 lbs. were applied to these areas according to the loading schedule. Instead of loading the left hand stabilizer with sand and pig iron weights a jig was built (figure 2) and attached to the tail of the fuselage. A concentrated load was then applied in such a location that the rear stabilizer beam (which was continuous across the fuselage) would have the correct shear and bending moment.

The concentrated load was applied by a spring dynamometer and turnbuckle attached to a bolt running through a hole in the floor. Figure 1 shows the method of applying the loads by using two automobile jacks. Deflection readings for this test condition were taken at four points by metal tabs fastened to the tail surface to which were attached strips of cross section paper having twenty squares to the inch. A fine wire stretched across the wooden standards provided a convenient method of reading deflections which were recorded as closely as 1/100″.

A small unit or initial load of 10% of the ultimate design load was used as a load at which all deflections were measured to determine the amount of permanent set. The loads were then applied in increments of 20% of ultimate design load up to the approximate yield point when the increments were reduced to 5% to get the yield point more accurately. Figure 3 gives the actual deflections of the midpoint of the front stabilizer beam and of the tip of the front stabilizer beam joint to the rear stabilizer beam. Since the load on the elevator was negligible the readings along the trailing edge of the elevator were not taken. Figure 3 shows clearly where the yield point occurred as the deflections began to vary from a straight line at 110% of the ultimate design load. These deflection readings were plotted as the test proceeded in order to correlate the skin wrinkles and any other sign of failure with the load in the region of the yield point and destruction point. In the case of Condition 1, which was the first test run, the stabilizer was not tested to destruction inasmuch as Condition 2 which is a more severe loading had to be run afterwards. The first test was discontinued after a permanent set of approximately ¾″ deflection was measured at the tip.

Condition 2 loading was then applied and the results are shown plotted on Figure 4. Curves 1 and 2 show a slight change in slope at 100% of ultimate design load which seemed too small a change compared with the change of slope recorded for the elevator trailing edge to expect a failure in the stabilizer beam. This was verified when the torque tube of the elevator failed at 100% of ultimate design load. The torque tube was reinforced and the test continued to destruction of the rear stabilizer beam.

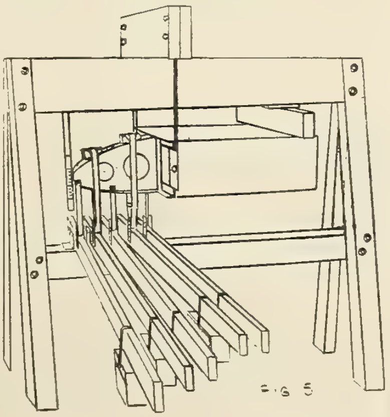


FIG 5

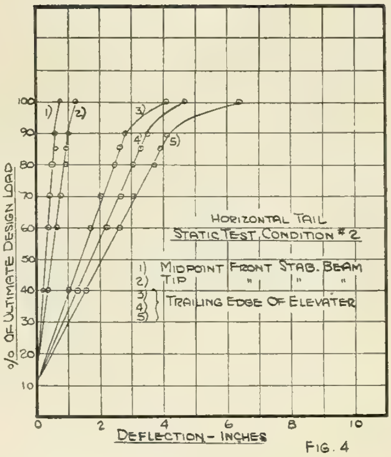


FIG. 4

After failure of the stabilizer beam the fuselage monocoque section was turned over on its side by removing the bolts which attach the heavy wooden bulkhead to the two I beams. The fin and rudder were then attached and a loading schedule made out. Loads were applied on increments of area (10″ wide) marked out on a piece of plywood as was done on the stabilizer and elevator. The rudder horn was held by a pin-ended ¼″ × ¾″ steel bar to eliminate any deflection of either the rudder torque tube or trailing edge due to deflection at the horn.

The aft end of the monocoque fuselage which had a large cutout approximately 6″ × 18″ long to accommodate the tail wheel was tested simultaneously with the tail surfaces. Deflection readings were taken at the fuselage rear bulkhead for Condition 2 loading on the horizontal tail surfaces which put bending and shear in the monocoque section. Torsion for the unsymmetrical loading condition was easily applied by the dynamometer and turnbuckle arrangement. This loading was continued until permanent set occurred as evidenced by permanent shear wrinkles of approximately ½″ deep.

Figure 5 shows a test set up for a leading edge rib. The rib was attached to a section of beam to approach as nearly as possible the actual loading conditions on the airplane. Loads were applied on both upper and lower surfaces, as pressure distribution tests have shown that the loading on the upper surface of the leading edge will be 60% to 80% of the total load. Actual loads were applied by filling the lever arms and pans with lead shot as shown in figure 5. Deflection readings were taken by the metal tab at the nose of the rib. As the test proceeded, deflections were recorded and plotted so that the yield point could be ascertained. As the yield point was approached, the load was removed to 10% of the ultimate design load to obtain the permanent set.

BRISTOL TYPE 138 MONOPLANE

The 335-457 hp plane which set a new world altitude record of 49,967 feet

● The British Air Ministry in 1934 commissioned the Bristol Aeroplane Co. to build a plane which could not only establish a new altitude record, but which also could be used for research work in the stratosphere once it had established its supremacy as an altitude craft. On Sept. 28, 1936, the Air Ministry had occasion to initiate test flights of this craft which was specifically designed for flight at 50,000 ft. and more. On that date Squadron Leader F. R. D. Swain, attached to the Experimental Station of the Royal Aircraft Establishment at Farnborough, took off from that point in the low-wing *Pegasus*-powered Bristol 138a, and after a flight of 3 hours 20 minutes (2 hours of which were at a height near the 50,000 ft. level) came down with a new record of 49,967 ft. He had surpassed the old record set by Georges Detre on August 14 by 1269 ft.

Exploring every technical angle of stratosphere flying long before the flight was attempted, attention was focused on the comfort and sustenance of the pilot at high altitudes, to the supercharging of the engine, and to fuel and oil requirements. Even before specifications for the plane were issued, it was decided that wing loading should not exceed 9 lbs./sq. ft., and the span loading (weight/$\sqrt{}$span) should not be greater than 1.4 lbs.

Although the plane was built primarily for high altitude research, the question of an attempt on the altitude record was considered as early as the design stage. Partly for this reason the plane was constructed as a single seater, but it is so designed that it may rapidly be converted into a two-place plane to accommodate an observer. As a two-seater provision is made for an electrically-operated camera and a radio installation, the camera being electrically heated to prevent freezing of the lens and the radio accumulator warmed by an electric blanket.

Early in the design of the plane, the use of a sealed pressure cockpit was investigated. Since this issue raised difficult design problems, and since the Siebe Gorman Co. was developing a sealed flying suit similar to a diving suit, it was decided to use this and provide enclosed cockpits.

Light structure was obtained by using wood throughout except for the engine mounting and cowling. The fuselage is a rectangular monocoque structure with a plywood skin glued and screwed through the mahogany corner longitudinals and stiffener struts, the whole being faired into a streamline shape. Forepart of the fuselage consists of the engine mounting with a fireproof bulkhead at each end, thus forming an all-metal fire insulated bay which contains the tanks for 82 gals. of fuel and 10 gals. of oil. This mounting is a duralumin ring attached to the front end of the fuselage by fully braced high tensile steel tubular members with steel fittings. The cowling is made up of quickly detachable aluminum alloy panels carried on frames and forming the nose section.

Pilot's Accommodations

Comfortable and warm accommodations were attained by seating the pilot aft of the rear wing spar in an enclosed and roomy cockpit which is insulated from cold, and is warmed by air flowing past oil coolers in the wing. Air flow is controlled from the cockpit by the pilot. The cockpit has a transparent sliding roof which can be opened or closed by a handle, and which can be quickly released for instantaneous opening in an emergency.

Provision is made to insure effective operation of controls by utilizing ball bearings throughout. Joints and ball bearings are dipped in thin gun oil, drained off, and then fitted in locked and sealed compartments, there being no grease cups or nipples.

Special instruments include barothermographs for recording atmospheric pressure and temperature. These instruments, made by the Royal Aircraft Establishment, are carried in the wings and are supported on springs to reduce vibration from the engine. Each instrument consists of a hollow drum on which a thin sheet of smoked metal is wrapped and which is rotated by the expansion or contraction of the outer skin of a coil of strip metal due to temperature changes. Arrangement is made for circulating air past this coil. A pointed arm pressing lightly on the smoked metal sheet, and causing a scratch, is moved by the action of the atmospheric pressure on a series of flexible boxes made of thin metal, and from which most of the air has been pumped. The scratched line given on the smoked metal sheet enables the atmospheric pressure at the greatest altitude and the temperature of the air at all lower altitudes to be determined.

In calculating the maximum altitude, the atmosphere through which the plane has flown is split up into a number of imaginary horizontal layers. Each of these layers has in effect been weighed by the instrument (the weight of a layer being proportional to the difference in pressure between the bottom and top of that layer) and as the density of each layer is known from its average temperature and pressure, the thickness of each layer can be calculated. The maximum altitude is the sum of all these layers.

Other instruments include an altimeter arranged to read up to 60,000 ft., turn indicators, oil pressure, boost and fuel gauges, oil thermometer inlet and outlets, air speed indicator, tachometer and bank indicator.

Wing structure is in three sections—two outer panels and the center section. The two outer wings, separately bolted to the center section, consist of three main spars with plywood webs and mahogany flanges, the whole being covered with thin (as little as .8 mm.) 3-ply plywood sheet. Construction of the empennage is similar to that utilized for the wing.

The landing gear is fixed, having split axles and faired struts. Equipment includes Dunlop medium pressure wheels, oleo shock absorbing struts, independently-operated Dunlop brakes and quickly detachable fairings.

Fuel tanks are mounted one on top of the other, the lower being the main tank with a capacity for 70 gals. The other, fed by a pump from the lower tank, contains 12 gals., which is sufficient for a 15-minute flight after the main tank is drained. With the experience gained from previous altitude flights and after considerable experimental work, a fuel known as S.A.F. 4 was chosen for the record-breaking attempt. This was developed from the standard grade of Shell Ethyl aviation gasoline 100 Octane.

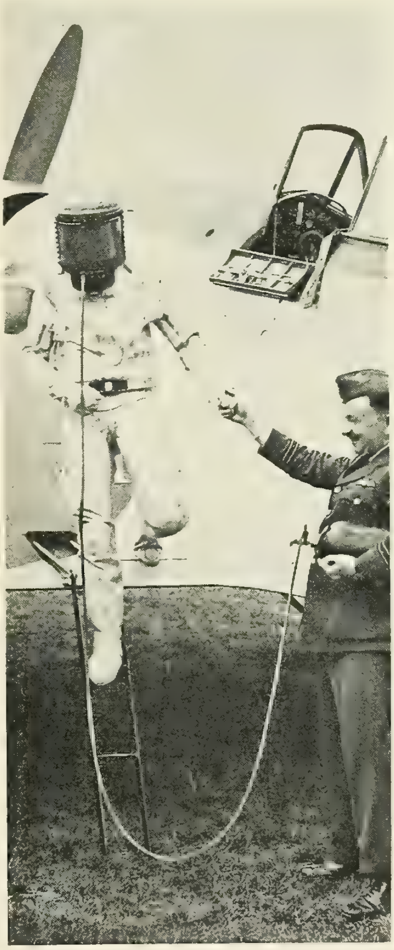
The engine is a special unit of the Bristol *Pegasus* series and is known as the P.E. VI S. It is equipped with a special two-stage blower which enables it to develop its maximum power at high altitudes, and has a 4-bladed fixed pitch wood propeller 12 ft. 9 in. in diameter and with 14-ft. pitch.

Engines in the *Pegasus* series have open ended cylinder barrels machined from a hardened alloy steel forging with a Y alloy head carrying the four valves. The crank shafts are two piece units of surface-hardened and tempered chrome nickel steel and crank cases are machined from hiduminium drop forgings split on the cylinder centerline joined by nine bolts which project rearward and secure the pressed steel cone mounting and supercharger assembly with rear cover and accessories.

Superchargers are of the centrifugal type with three different gear ratios. Pistons are of the full skirted type forged from hiduminium stampings. Propeller shafts are so designed as to be suitable either for fixed or controllable pitch hubs.

Pre-flight Calculations

Pre-flight calculations indicated that the plane could climb from the take-off at a rate of 1040 ft./min. with the engine developing 370 hp.; that it could reach 10,000 ft. in 9.5 min., when it would then be climbing at 1060 ft./min., with the engine developing 335 hp. In 35 min. it was calculated it could reach 40,000 ft., climbing 1430 ft./min. with the engine developing 457 hp. It was further estimated that the plane could attain 50,000 ft. in 46 minutes, the rate of climb then being 580 ft./mi., and the engine producing 380 hp. The service ceiling of 54,000 ft. was to be attained in 63 min. at which time the rate of climb would be 100 ft./min. From flight tests, it is understood these estimated figures have been exceeded to some extent.



Squadron Leader F. R. D. Swain and his high altitude equipment

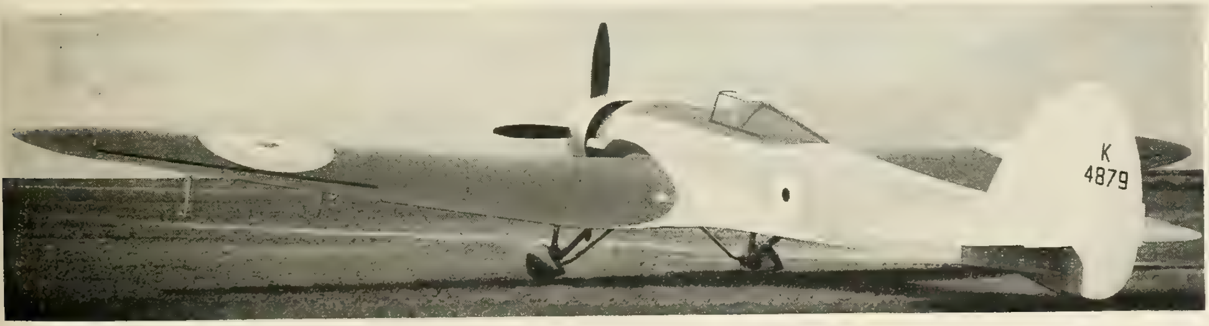
The aircraft takes off in about 360 ft., and its speed near the ground (with the engine delivering 400 hp.) is about 123 mph. Fuel consumption is approximately 35 gals. in 65 min. by which time the ceiling should be reached. Engine rpm increases from about 1440 at sea level to about 2590 between 45,000 and 55,000 ft.

The pilot's sealed suit is inflated to a pressure adequate to sustain life at any altitude. It is made of rubberized fabric, fitted with a helmet of the same material with a large curved double window. The suit is made in two pieces, a pipe clip type joint being made around the waist. A panel is incorporated in the helmet to enable the pilot to free his head quickly in an emergency. Breathing circuit is of the closed type, oxygen being fed into the circuit at the required rate, the oxygen jet being the driving element in a small injector which produces a rapid circulation of gas around the system. From the injector the gas passes through a flexible tube entering the helmet on the right hand side of the face and passing across the face to an outlet on the left. The gas containing the exhaled breath passes down the flexible tube to a canister containing chemicals which absorb the carbon dioxide and moisture from the breath. It then issues from the canister outlet as pure oxygen to be re-circulated through the system. Accessories for inflating and deflating controls and gauges for registering the pressure in the oxygen cylinders and in the suit are provided in convenient positions for operation and inspection during flight.

The load which the aircraft was expected to carry on the altitude attempt is divided as follows: pilot, 180 lbs.; special suit, 30 lbs.; oxygen apparatus, 40 lbs.; parachute, 20 lbs.; special instruments, 100 lbs.; fuel and oil, 549 lbs., giving a total weight of 919 lbs.

Specifications of the stratosphere Bristol 138a are as follows:

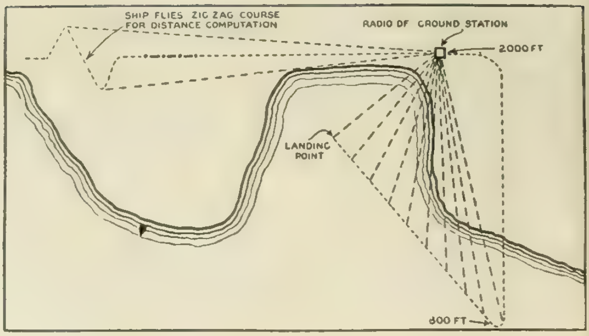
Wing span	66 feet
Length overall	44 feet
Height overall	10 feet 3 inches
Root chord	12 feet
Mean chord	8 feet 6 inches
Wing loading	8.53 lbs./sq. ft.
Empty weight	4391 pounds
Useful load	919 pounds
Gross weight	5310 pounds



INSTRUMENT LANDING SYSTEMS FOR AIRCRAFT

(Part II)

HENRY W. ROBERTS



Pan American Airways navigate their ships from the ground. Blind landings are made with the help of bearings taken by shore station

● Before resuming our description of the eight systems of instrument landing developed to date, we will restate the general requirement of any such system, namely: that it must automatically and continuously furnish the pilot three-fold information—in what direction the airport lies; how far away; and how far down. This information defines a three-dimensional landing path from a point in space above the ground to a point within the airport limits, and enables the pilot to bring his ship down without seeing the ground by keeping him continuously posted as to his exact position with respect to this path.

Three systems of instrument landing—Bureau of Air Commerce, Army-Hegenberger, and United Air Lines—were described in the preceding installment; description of the remaining five systems follows:

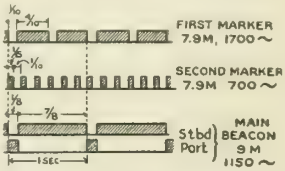
Pan American Airways System

The peculiar operating problems of this company necessitated development of special radio aids to navigation. This work was carried out largely by their own staff, and the equipment and methods evolved differ materially from those used in the familiar overland operations.

Unlike any other airline, Pan American navigate their ships from the ground. The long non-stop overwater schedules take their ships far beyond the maximum useful range of the most powerful range beacon; besides, a fixed radio lane would be futile as their ships often fly several hundred miles off the normal course to avoid storm areas.

Radio navigation is done entirely with the aid of shore radio direction finders, the procedure of taking radio bearings being precisely the reverse of the usual practice. The ship transmits a steady signal, and the ground station takes its bearing and radios it back to the ship. For position fix, the airplane flies a zigzag course, and the position is then computed by triangulation (or two stations not lying in a straight line with the airplane can fix its position by cross bearings). In this manner, all problems of radio navigation are solved in well-staffed quarters ashore, leaving the flying personnel to attend to actual flying. This also permits employing far more accurate and complex radio equipment than any airplane could possibly carry.

The accompanying illustration shows a typical instrument landing procedure at a Pan American station. The landing begins while the airplane is still a hundred miles out and the pilot requests his position fix and landing information—weather, barometer, direction and force of wind, direction and height of waves, and the landing zone he is to use.



Modulation frequencies and keying speeds of the Lorenz blind landing system

The navigating officer aboard the airplane consults a large-scale map of the bay and locates the precalculated radio course for the "blind" landing under the given conditions. As the ship nears the station, the bearings are being transmitted at 30-second intervals until the ship flies directly over the antennas, at 2000 ft. The pilot makes a turn in the prescribed direction and sets his automatic pilot for descent at the rate of 200 ft./min. Simultaneously, the navigating officer starts a stop watch and calls out to the pilot the number of seconds remaining until the next change of course, while the shore station checks the ship's actual position at 15-second intervals. Six minutes later the ship is at 800 ft., and the pilot again changes his course, in accordance with the pre-calculated map, for the actual blind approach and landing.

Bearings now come at 10-second intervals. They serve as a position and altitude check to the navigating officer who calls out the number of seconds remaining before landing; the last ten seconds are called out singly. The final check, during the last 50 ft. of descent, is a surge of sound in the pilot's earphones as the airplane's transmitter begins to resonate as the surface of water is approached. (The resonance check is still in experimental stage.)

In comparison with more involved systems, the Pan American system of instrument landing is rather elementary. Like all their operations, it is characterized by

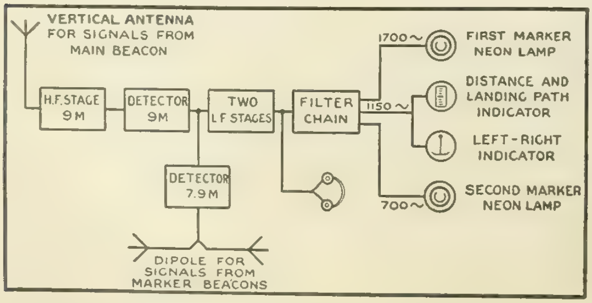
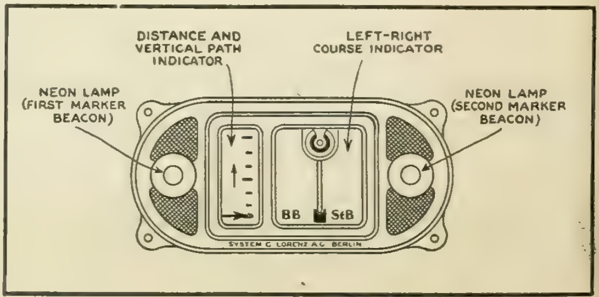
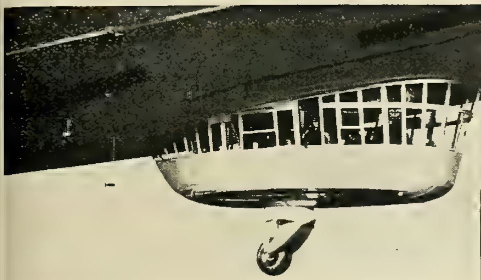


Diagram of the receiving equipment used with the Lorenz blind landing system. The main and marker beacon signals are combined for aural reception, then filtered out for separate visual indication


DISTANCE AND VERTICAL PATH INDICATOR
LEFT-RIGHT COURSE INDICATOR
NEON LAMP (FIRST MARKER BEACON)
NEON LAMP (SECOND MARKER BEACON)
BB
StB
SYSTEM C. LORENZ A.G. BERLIN

The Lorenz blind landing indicator. The functions of the two pointers correspond to those of the American combined instrument. The marker beacon signals are received by flashing neon lamps



Control car of the Zeppelin "Hindenburg." Two of the three sets of radio direction finding loops, used in blind landings, are seen just ahead of the car. Two of the trailing antennas, partly reeled in, used for communication, are seen aft

A corner of the radio room. Short wave transmitter is located at left, and the long wave at the right; between them are short and long wave receivers

thoroughness. They reduced this complex problem to elementals, and pre-rehearsed and pre-calculated its procedure a hundred times until each one of the seven or eight men needed for an instrument landing knows his job.

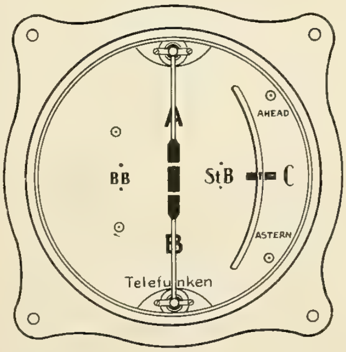
Lorenz System

The most important European instrument landing development is undoubtedly the Lorenz system. Like the Diamond-Bureau of Air Commerce system on which it is based, it automatically and continuously provides the three-fold landing information. It differs, however, in many respects from the original Newark installation. Although the original Diamond principles remain unchanged, the methods of transmission, reception and indication of landing intelligence have been improved and simplified.

The most notable improvement is in the transmission of vertical guidance. Instead of using separate transmitting systems operating on different frequencies—two crossed loops for direction, and a special antenna array for delineation of the landing path—the Lorenz system uses a single antenna array consisting of a vertical dipole transmitting antenna and two reflectors. The crossed loops of the Diamond system are replaced by the two dipole reflectors, keyed with interlocking dots and dashes, which produce, in conjunction with the transmitting dipole, an equisignal zone, or beam, which leads the pilot to the runway. At the same time, the transmitting dipole of this array is so constructed that the ground reflection directs the line of its maximum radiation at an angle to the ground throughout 360° around the dipole. The angle of maximum radiation corresponds to that of the unidirectional Diamond landing beam, and the pilot follows a line of constant field intensity in the identical manner as with the Diamond system.

The indication of the landing intelligence has also been improved. The vertical pointer (for directional guidance) remains unchanged, but the crossed horizontal pointer (for vertical path indication) has been combined with a new scale. As the airplane approaches the airport, in level flight, the pointer rises, and the graduations of the scale indicate the rate of approach and approximate distance. When the pointer reaches the center mark on the scale, the pilot begins his glide. Thereafter, the pointer remains centered so long as the pilot follows a line of constant field intensity to the runway.

Absolute longitudinal guidance is identical with that of the Diamond system, except that the two marker beacons transmit dashes and dots, respectively, instead of two different audiofrequency notes. The marker beacon signals can be received either aurally or visually, the latter by causing the received keyed signal to flash the appropriate neon light on the instrument board.



Telefunken combined instrument for airship blind landings. It shows simultaneously direction of three transmitting stations operating on different frequencies

The Lorenz system, which can be called the standard system of Europe, is now in operation at several airports, among them Berlin, Zurich, Hanover, and Munich. It is of particular interest to us because it represents the logical advancement of the original Diamond system.

Zeppelin-Telefunken System

Like Pan American Airways, Deutsche Zeppelin Reederei were confronted with the need of an instrument landing system to meet their particular operating requirements. The Zeppelin-Telefunken system, developed by these two companies in cooperation with Deutsche Versuchsanstalt fuer Luftfahrt, is another instance of a specialized instrument landing system.

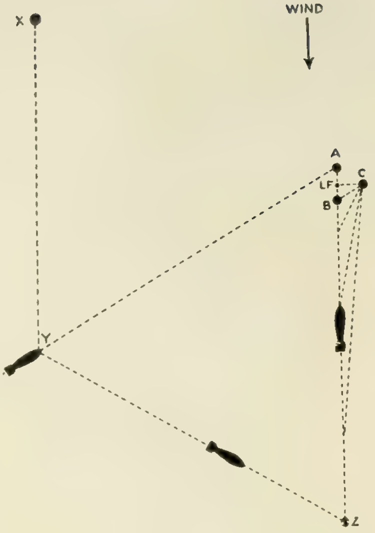
Its principle of operation is reminiscent of our Army-Hegenberger system, but in addition to two mobile transmitters operating on separate frequencies, for runway localization, it employs a third transmitter for definite position fix within the airport limits. This necessitates three separate radio direction finders aboard the dirigible.

Ground equipment consists of three transmitters with extensible non-directional pole antennas mounted on trucks, disposed about the airport as shown in the drawing: transmitters A and B oriented in the direction of the wind, and transmitter C opposite the center of the airport, at right angles to line A-B. The transmitters are long-wave, the wave lengths being 701.4 meters for A, 1093.8 meters for B, and 872.1 meters for C.

The dirigible approaching the airport takes a bearing on the windward transmitter A, and determines position and distance from the airport by a cross-bearing on any convenient station (X, in the diagram). The ship then proceeds to a point about 10 miles leeward of the airport, and lines up with transmitters A and B for landing approach.

In the control car, the bearings of the two transmitters, A and B, are indicated by two opposing vertical pointers of the combined instrument. At the same time, a third radio direction finder is tuned in on transmitter C, the direction of which is now shown in the control car by the movement of the third pointer, visible through a slot in the right hand side of the dial. The three pointers give a constant direction and position indication as the dirigible, losing altitude, approaches the airport.

When the three pointers are brought to their lubber marks, the commander knows that his ship is directly over the center of the airport. The customary altitude here is about 325 ft., and the handling lines can be paid out as the airship, keeping its position, descends.



Telefunken blind landing system used by the dirigibles "Graf Zeppelin" and "Hindenburg." Mobile transmitters A, B and C are oriented about the landing field as shown in the drawing in order to permit landing into the wind

Loth Electromagnetic System

The use of the electromagnetic field emitted by a series of concentric underground wires for locating fogbound airports had been proposed in the United States in the early 1920s. The first practical application of the idea, however—and the first to employ these means for altitude indication—was made by William Loth, in France, a few years ago when an installation was made at the Villeneuve airport.

The accompanying sketches illustrate the principle of its operation. The two outer concentric rings, surrounding the landing area, emit a relatively powerful field, forming a safety dome over the airport; the outer field forms an approach zone surrounding the airport. Within the two outer rings, there are 18 low-power concentric rings for altitude indication (only 4 such rings are shown in the drawing for clarity). Twelve rings per kilometer of airport diameter were found adequate.

Each two adjoining rings constitute a pair, and each pair is charged with equal alternating currents, but of opposite phases. In this manner, the magnetic fields about the wires are being rapidly reversed and produce a resultant field. By keying the rings in a suitable manner it is possible to provide means of identification of the approach zone, the safety zone, and the landing zone.

The outermost ring is keyed with letter D (dash-dot-dot), and its neighbor is keyed with letter U (dot-dot-dash) in such a manner that the two signals interlock. The keying is arranged to coincide with the switching of the magnetic fields. Thus, letter D is keyed to coincide with the outward propagation of the magnetic field, while letter U coincides with its inward propagation, towards the center of the airport. This provides a means of identification of the approach and safety zones, with a definite check on the airport boundary where the two signals interlock and produce a single continuous note. This single continuous note is confined to the narrow zone directly over the outer pair of rings.

All low-power inner rings are keyed with letter I (dot-dot) which identifies the "radio ceiling" produced by their combined fields, extending to a height of about 65 ft. above the airport.

Both visual and aural reception is provided, the former by varicolored lights which flash as the airplane passes through the various zones, the latter by code letter identification.

Having located the direction of the airport by means of a radio direction finder or a localizing beam, the pilot descends to a safe altitude and heads for the airport, listening for the letter D in the outward component of the magnetic field. When the airport boundary is reached, the signal briefly changes to a single continuous note as the airplane passes directly over the two outer rings. Once over the airport, inside the "safety dome," the letter U of the inward component of the magnetic field furnishes the zone identification. Continuing his glide, the pilot listens for the letter I of the "radio ceiling," giving him the final altitude check.

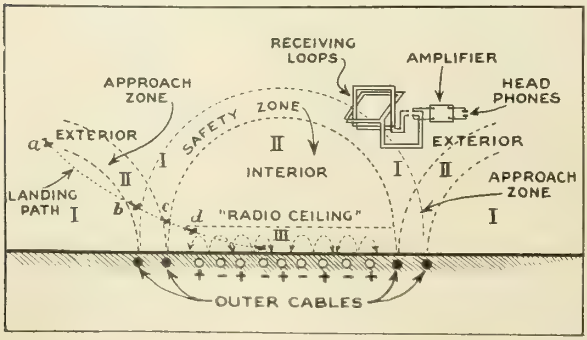
The Villeneuve installation and tests were made for the French Air Ministry, and their results, as far as the writer knows, have not been made public.

Simon System

An interesting system has been proposed by E. J. Simon, but as yet has not been tested in flight. Its feature lies in the ease with which it could be applied as a collision warning system for ground obstructions or aircraft in flight.

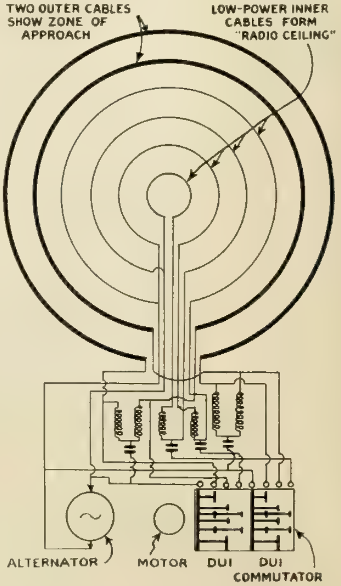
The system is predicated on the use of the Simon Radioguide (described in the May, 1935, issue of Aero Digest), a

(Continued on following page)

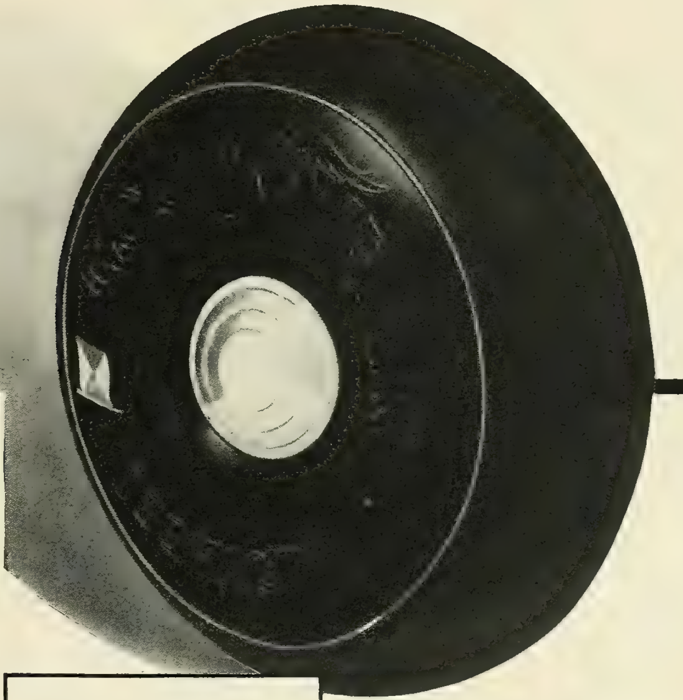


Schematic diagram of the Loth electromagnetic blind landing system (left)

Lines of force of the Loth electromagnetic system (right) showing how the pilot finds the airport. Insert shows loop antenna system employed for reception of radio signals


TWO OUTER CABLES SHOW ZONE OF APPROACH
LOW-POWER INNER CABLES FORM "RADIO CEILING"
ALTERNATOR
MOTOR
DUI
DUI
COMMUTATOR

AIRWHEEL*
—FIRST-CHOICE FOR SAFETY



THERE'S a very simple reason why so many large transports and private aircraft are equipped with Goodyear Airwheels.

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These big rubber "feather-beds" not only protect the whole ship from ground stresses and vibrations in routine landings, but they make safe emergency landings possible on ploughed ground, mud, sand, snow and other hazardous conditions that bog ordinary tires!

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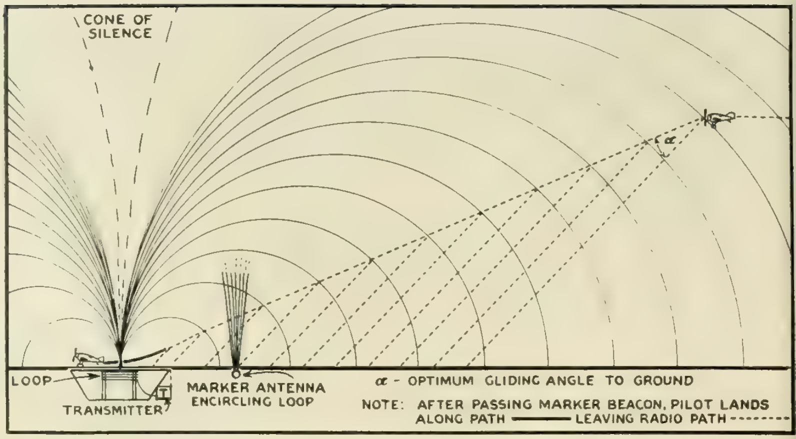

CONE OF SILENCE
α
LOOP
TRANSMITTER
MARKER ANTENNA ENCIRCLING LOOP
α - OPTIMUM GLIDING ANGLE TO GROUND
NOTE: AFTER PASSING MARKER BEACON, PILOT LANDS ALONG PATH ——— LEAVING RADIO PATH -------

In the Simon blind landing system, the pilot can approach the field from any angle and at any altitude, and begin his glide at a point where the optimum gliding angle is shown on the instrument

radio direction finder with two oppositely inclined loops operating on a ratio principle. Use of this principle permits, in addition to the conventional direction finding, automatic indication of off-course bearings in degrees of arc, as well as an indication of the ratio of distance flown.

For determination of bearings in azimuth, the two loops are placed (with their axis vertical) at equal and opposite angles to the longitudinal axis of the airplane. For determination of bearings in zenith, it is proposed to place the loops, with their axis horizontal, at equal and opposite angles to the horizontal axis of the airplane. Such an arrangement would permit measuring, in degrees, the zenithal angle from a point in space to a suitable source of signal at the airport emitting horizontally polarized waves.

The ground installation of the Simon system consists of a horizontal transmitting loop antenna located underground at the center of the airport, transmitting a steady carrier, which may be modulated, if desired, since this does not affect the bearing indication. The field of such a loop antenna provides directional and vertical guidance throughout 360°.

In the proposed landing procedure, the pilot would approach the field, from any direction and at any altitude, and observe the zenithal bearing indication on his landing instrument. When the instrument shows that the zenithal bearing to the airport is equal to the normal gliding angle of that particular airplane, the pilot would begin his glide which would eventually bring him to the center of the airport, directly on top of the underground antenna. To offset variations in indication caused by the airplane assuming a tail-low or tail-high position during the glide, it is proposed to suspend the receiving loop unit aboard the airplane in gyroscopic gimbals, or to compare the radio bearing indication with the inclinometer indication, adding or subtracting the difference in the airplane's actual angle with the horizon.

Approximate longitudinal guidance would be constantly available through the inherent feature of the instrument which gives an indication of the ratio of the distance traveled; absolute distance check would be provided by the conventional marker beacons, such as used in the Diamond, United and Lorenz systems.

Conclusions

The need for an instrument landing sytem may be said to increase with the distance flown non-stop. The greater the distance, the less frequently will clear weather prevail at both the point of departure and the point of destination. Accurate long-range weather forecasting does not solve the problem. It is significant that the two companies operating non-stop over the longest distances—Pan American Airways and Deutsche Zeppelin Reederei—both found it necessary to have means of landing their ships without seeing the ground.

Instrument landing today is a practical reality. Why, then, is this most vital aid to navigation still being withheld from our domestic airlines?

The reason can scarcely be technical. Standardization and responsibility—is all that is needed. As to responsibility for nation-wide construction, maintenance and operation, no single airline, or group of airlines operating from the same airports, should shoulder such a burden. This burden, like the operation of radio range beacons, would undoubtedly fall to the lot of the Federal Government.

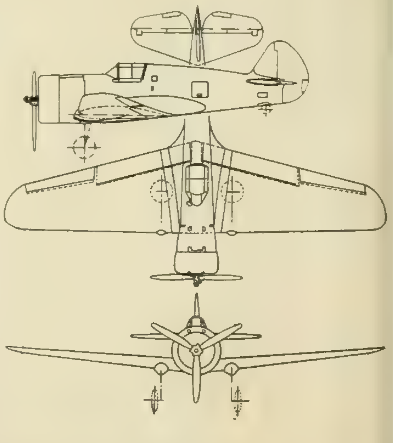
Curtiss P-36 Pursuit Monoplane

● Latest pursuit plane purchased for the U. S. Army Air Corps is a low-wing all-metal cantilever monoplane manufactured by the Curtiss Aeroplane and Motor Co. of Buffalo, N. Y., which is now producing this type for immediate delivery.

Known as the Curtiss P-36, this plane is equipped with retractable landing gear and tail wheel as seen on the front cover of this issue of Aero Digest. Power is supplied either with the new 1000 hp Series G Cyclone, the nine-cylinder radial air-cooled engine developed by the Wright Aeronautical Corp., or the 14-cylinder, two-row radial Pratt & Whitney R-1830 which develops 1150 hp.

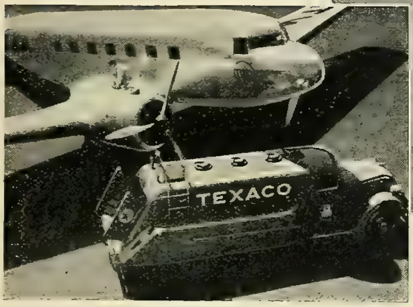
Full monocoque construction is used in the all-metal fuselage, and the wings are provided with trailing edge flaps. These flaps are effective in producing a low landing speed in comparison to the high speed of the plane. The empennage is also cantilever construction and the elevators and rudder are equipped with trimming tabs of the Flettner type.

Wing span is 37 ft. 35 in., height 28 ft. 1 in. and dihedral 6°. Performance figures on the P-36 are not available due to the confidential status of the airplane.



Balanced distillation characteristics

reduce carburetor icing



(Right) — Testing gasoline for distillation characteristics. Texaco Aviation Gasoline is processed by special refining methods. We can control the distillation curve to very narrow limits.

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YOU can lower the temperature of your "hot spot" and still reduce the possibility of icing.

This exceptional performance is only possible when the distillation temperatures at 10%, 50% and 90% of the volume are held to exacting limits and bear a definite ratio to each other.

Because Texaco has access to all types of crudes, Texaco refiners select only those crudes that have the necessary characteristics to maintain this balance.

Texaco Aviation Gasoline is processed by exacting refining methods that enable us to control the ratio of these temperatures exactly.

Because of this you get a uniform product that gives added margin of safety in the operation of your planes. The reduction of temperature helps to obtain greater power output from your engines.

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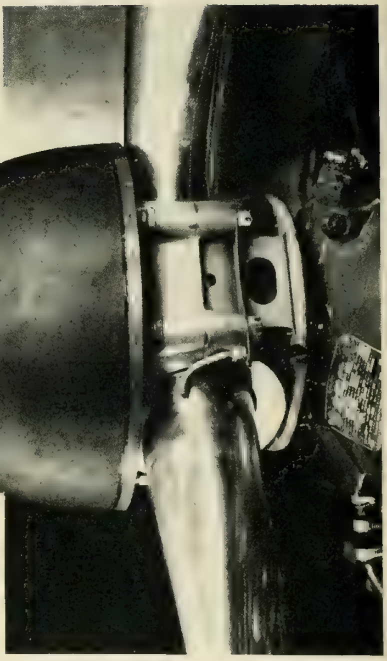
INSTALLATION OF DE-ICER EQUIPMENT FOR WINTER AIRLINE SERVICE

FRED L. HATTOOM



Propeller de-icer, or "slinger ring" developed by TWA. Below, mechanics installing rubber "overshoes" on main wing leading edge

● Transcontinental & Western Air, Inc., is repeating the precedent it set last year by again making a complete installation of de-icer equipment on all of its skyliners in preparation for winter flying this season. This precaution was not used as a means of combating icing conditions but rather as a protective measure in the event ice forming conditions were encountered in flight. Known or anticipated icing conditions were avoided.

Other than in the matter of one replacement, all of the equipment used last season is being re-installed this year. The various units—spinners, propeller de-icers, rubber overshoes for wings, fins and stabilizers, and the antenna pull cord—represent a weight of 177 pounds to each plane. The installation does not mean adding that much additional weight, as much of the piping, valve groups and mechanism is not removed from the plane. Only the exterior functioning units are taken off and stored for the summer, other parts remaining installed in the plane's structure. A complete replacement is being made this season only in the rubber overshoes used on the leading edge of the plane's wing.

These overshoes are pulsated by a valve group assembly and cause a creasing and breaking action of any ice that might adhere to the leading edge. Since ice forms first on this part of the wing, it is thus thrown off before it has a chance to build up.

Rubber overshoe development dates back to 1928 when experiments were conducted first by Dr. William C. Geer, a research chemist, Dr. Merritt Scott of Union College at Schenectady, Wesley L. Smith (then with National Air Transport) and members of the B. F. Goodrich Company's research department. This development was the first determined attempt by a scientific group to discover a means of preventing the formation of ice on planes. There was no precedent in the matter of the most suitable materials or of any principles to follow. The only known fact was the detriment to flying involved in icing conditions.

Cornell University opened its physics laboratory to the group for the experimental work. A wind tunnel was constructed and by means of a refrigeration system, a pronounced icing condition was established.

A wing section was placed in the wind tunnel and the icing condition was permitted to perform its activity under the inspection of the group. Ice formed on the entering edge; the accumulation increased and spread. Various materials for a de-icer to be applied to the entering edge were used and a rubber covering over a rubber tube resulted. The number of tubes was increased to five but the rubber coating only took a position tangent to the tubes when inflated and did not provide a breaking action. The formation of ice merely was pushed forward when the tubes were inflated and returned to the wing's edge when the tubes deflated.

The ultimate development was found in a rubber coating having built-in tubes. In this manner, the inflating action would cause a creasing between the tubes and a breaking action on the adhered ice. Under this system, the three-tube de-icer proved most suitable and is the principle used today and manufactured by the B. F. Goodrich Co.

A similar overshoe of smaller size and slightly different construction is being applied to the vertical fins and the horizontal stabilizers. A single tube weaving back and forth under the rubber coating is used in the fin and stabilizer de-icer.

One of the most successful of last winter's operations is the propeller de-icer, known as the slinger ring. This device (described in detail in the February, 1936 issue of Aero Digest) was developed by TWA in the company's plant at Kansas City, Mo., and will be a part of the de-icer equipment to be re-installed on the company's planes this year. It is interesting to note that this device functioned so successfully in the first season of its operation in preventing the formation of ice on propellers that it is being adopted generally by the air transport industry.

(*Continued on page* 86)

● *"Overshoes" consisting of a single tube under the rubber coating, are used in the de-icer for fin and stabilizer leading edges*

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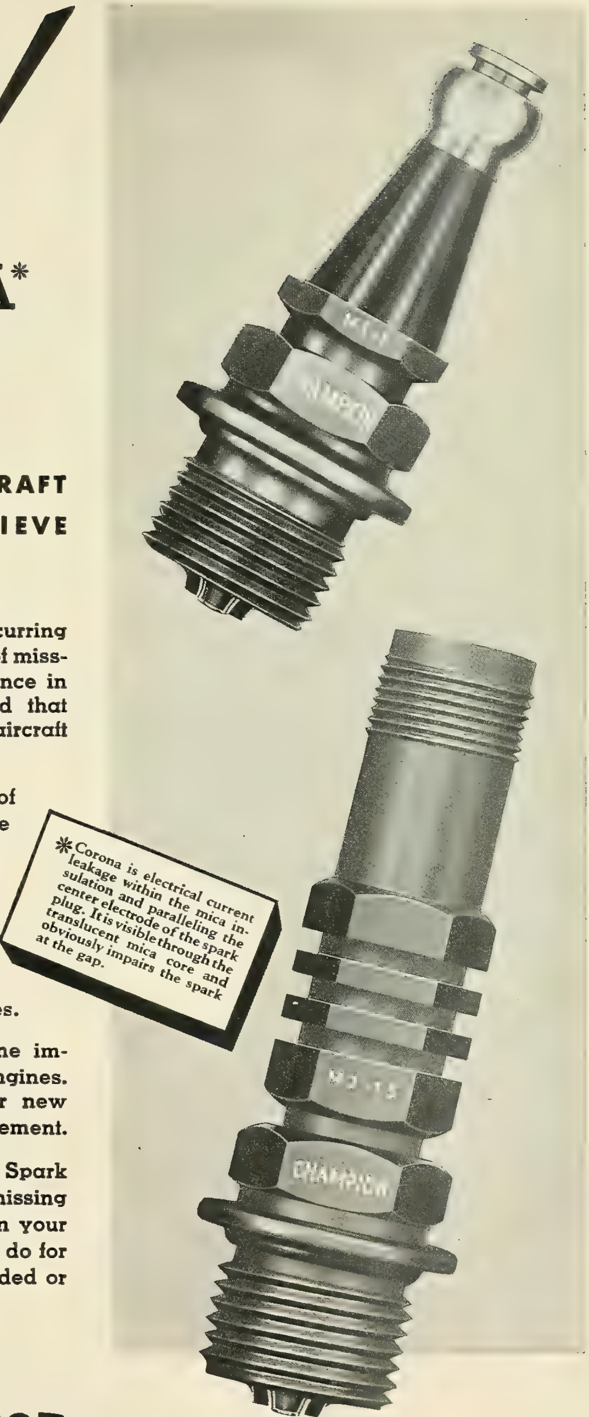

*Corona is electrical current leakage within the mica insulation and paralleling the center electrode of the spark plug. It is visible through the translucent mica core and obviously impairs the spark at the gap.

CHAMPION NOCORONA MICA AIRCRAFT

SPARK PLUGS

TAIL LOADS IN A STEADY DIVE

WILLIAM H. MILLER
and
PEYTON M. MAGRUDER

● In the October issue of AERO DIGEST, the authors described a method of calculating the dive terminal velocity of an airplane.(1) The following analysis has been carried out with the object of evolving a method of determining the equilibrium conditions in a steady dive, with special reference to the magnitude and distribution of the air load over the horizontal tail surfaces.

The specific questions answered in this article are: when the airplane is put into a steady dive (glide) at the constant terminal velocity, V, what are the angles of attack of wings and tailplane, the angular setting of the elevator, and the loads on wings and tail surfaces. In particular, it is intended to show a method of calculating the distribution of load between the stabilizer and elevator, and the hinge moment of the latter. This information must be obtained before the same question can be answered relative to the pull-out from a dive, but the solution of the equations of motion for the pull-out, and the calculation of the loads on wings and tailplane for that condition, will be reserved for a subsequent article.

It has been found most convenient to refer the motion of the airplane to "earth axes" while resolving forces along the tangent and normal to the path of flight. Thus a set of Cartesian coordinate axes, with the z axis parallel to the indicated gravitational force vector, serves as the reference frame for the other set of "wind axes." With this arrangement, the equations of motion may be written:

$$\frac{W}{g} \cdot \frac{dV}{dt} = D + W \sin \theta \ldots\ldots\ldots\ldots (1)$$

$$\frac{W}{g} V \frac{d\theta}{dt} = L - W \cos \theta \ldots\ldots\ldots (2)$$

$$\frac{W}{g} k_B{}^2 \frac{d^2(\theta+\alpha)}{dt^2} = M \ldots\ldots\ldots\ldots (3)$$

For the steady dive one obtains simply

NOTATIONS

Subscripts

E, engine
W, wing
t, tailplane
e, elevator
R, rear beam
F, front beam
B, axis of pitch

Basic Symbols

H, hinge moment
M, moment
V, velocity
S, area
T, thrust
Q, torque
W, weight
i, incidence

E, downwash angle
δ, elevator angle
L, lift (or load)
k, radius of gyration
c, chord of main wing
FHP, friction bhp
θ, angle of glide or drive
α, angle of attack of wing
J, (V/nD) where D is diameter
α', angle of attack of tailplane
D, drag or propeller diameter
n, revolutions of propeller in unit time
c', chord of tailplane (or element of same)
c'', chord of elevator (or element of same)
ρ, distance from leading edge to cp as fraction of chord
C, coefficient (Note: C_{Lt} is lift coefficient of tailplanes etc.)
r, distance from cg to leading edge of mean chord of tailplane
h, distance of thrust line above cg
y, spanwise distance from centerline of chordwise section of horizontal tailplane

$$D + W \sin \theta = 0 \ldots\ldots\ldots\ldots (1')$$

$$L - W \cos \theta = 0 \ldots\ldots\ldots\ldots (2')$$

$$M = 0 \ldots\ldots\ldots\ldots (3')$$

Equation (1') may be written $W \sin \theta$ = (Airplane Drag) + (Propeller Drag) and, by the method given in the October issue of AERO DIGEST, the terminal dive (or glide) velocity may be determined.

When reduced to non-dimensional form, the equations of equilibrium become (approximately)

$$\frac{W \sin \theta}{qS_w} + C_D + \left[\frac{2C_T}{J^2}\right]\left[\frac{D^2}{S_w}\right] = 0 \ldots (4)$$

$$-\frac{W \cos \theta}{qS_w} + C_{Lw} + C_{Lt}\left[\frac{S_t}{S_w}\right] = 0 . (5)$$

$$C_{Mw} - C_{Lt}\left[\frac{S_t d}{S_w c}\right] + \left[\frac{2C_T}{J^2}\right]\left[\frac{hD^2}{cS_w}\right] = 0 \ldots\ldots (6)$$

In regard to signs: The propeller thrust is positive if it acts in the same direction as the airplane drag (i.e., in normal flight the thrust is negative). The thrust moment arm, h, is positive if the thrust line is above the center of gravity of the airplane (since usual stalling moments are positive). In the above non-dimensional equations, D is the propeller diameter, and the thrust coefficient is defined by

$$C_T = T/\rho n^2 D^4$$

In climb, θ is positive and in a glide (or dive) negative.

Before attempting to solve the equations of equilibrium, some remarks concerning the determination of the wing cellule characteristics are pertinent. The distribution of total lift between the individual wings of the biplane, and the aerodynamic mean chord, may be determined by original or prescribed methods with which all designers are familiar. In NACA TR No. 501(2), Diehl gives a universally employed theoretical-empirical method of calculating the relative loadings of the wings of the general biplane. We assume that these calculations have been performed, together with the calculations of the pitching moment co-

(*Continued on following page*)

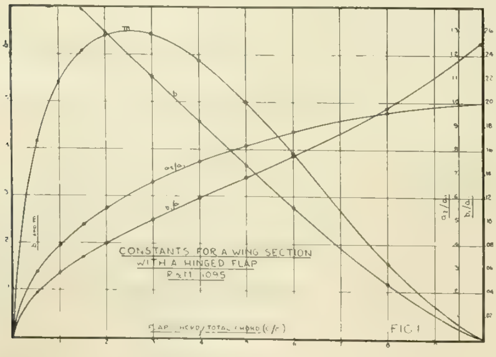

FIG 1

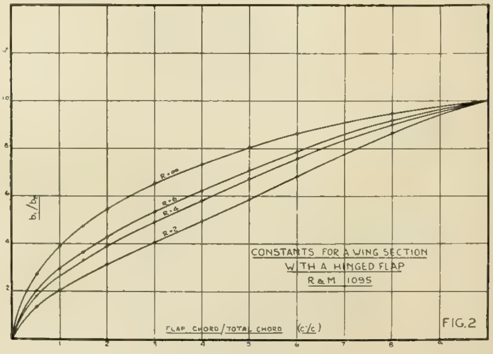

FIG.2

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(1) Miller, W. H., and Magruder, Peyton M., *Calculation of the Terminal Velocity of an Airplane in a Vertical Dive*, AERO DIGEST, October, 1936.

(2) Diehl, W. S., *Relative Loadings on Biplane Wings of Unequal Chords, NACA TR 501.*

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The new Series "G" 1000 H.P. Wright Cyclone is installed in all of the latest twin-engined Douglas Army Bombers, four-engined Boeing Army Bombers, Martin Bombers, Curtiss Army Pursuits, Curtiss twin-engined Army Attacks, Grumman Navy Fighters, North American Army Observation and many other advanced types of military planes now being built for the U. S. Army Air Corps and the U. S. Navy Department.

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(*Continued from preceding page*)

efficient, with respect to cg, as a function of angle of attack.

The following equations, originally derived by Munk⁽³⁾ and Glauert⁽⁴⁾ and Pinkerton⁽⁵⁾ are employed to determine the tailplane characteristics.

Lift coefficient of tailplane:

$$C_{Lt} = L_t/qS_t = a_1\,\alpha' + a_2\,\delta$$

$$= a_1\,[\alpha' + (a_2/a_1)\,\delta]\ ..(7)$$

Moment coefficient of tailplane referred to quarter point of geometrical mean chord

$$C_{Mt} = M_{c/4}/qc'\,S_t = C_{Mo} - m\,\delta\ ..(8)$$

where C_{Mo} is the moment coefficient with elevator neutral.

Coefficient of lift on elevator

$$C_{Le} = L_e/qS_e = n_o\,C_{Lt} + n\,\delta\ ....(9)$$

Hinge moment coefficient of elevator

$$C_H = \frac{H}{qc''S_e} = (b_1\,\alpha' + b_2\,\delta)$$

$$= -\,a'\,(b_1/a_1)\,(a' + (b_2/b_1)\,\delta$$

$$= -\,(b_1/a_1)\,(C_{Lt} + b\,\delta)\ ..(10)$$

The parameters (a_2/a_1), (b_1/a_1), (b_2/b_1), m, b, n, and n_o taken from references (3), (4), and (5), are plotted in figures 1, 2 and 3. It is important to note that the following are independent of aspect ratio: (a_2/a_1), (b_1/a_1), m, b, n, and n_o. Theoretically C_{Mo} the moment coefficient about the quarter point of chord of the symmetrical airfoil is zero, and it will be so considered in the remainder of the article. In some practical cases, however, it may not be zero and accordingly the aerodynamic center of the section should be used as a reference.

Returning again to the equilibrium equations it will be seen that in order to solve them, two additional relations are necessary—an equation connecting V (or q) and J (or C_T), and a relation between the wing cellule characteristics. In the October issue, the authors described a method of solving these equations for the zero-lift dive, ($\theta = -90°$), and for this case the terminal velocity was calculated. It was shown that a curve of V versus J could be obtained by equating the propeller torque coefficient

$$C_Q = Q/\rho n^2 D^5 = f\,(J)$$

to an engine torque coefficient obtained from the friction horsepower curve by means of the transformation

$$C_{QE} = 550\ \text{FHP}/2\pi\rho n^3 D^5 = f\,(n)$$

Then for equal values of C_Q and C_{QE} the corresponding values of n and J were found, and V obtained from $V = J\,(nD)$. Since C_T is always a known function J, and since, then, corresponding values of V and J were also known, it was easy to plot $(C_T/J^2)\,(D^2S_w)$ versus V.

The complete solution of the equations of motion in the general case is not possible except by graphical means. Even then the process is too laborious for practical use until some simplifying approximations are made. The most accurate approach to the general solution is attained if one simply assumes an appropriate value for the effective moment-arm of the horizontal tailplane. It will be conservative for design purposes to consider that the center of pressure of the tailplane remains constant and equal to its value for neutral elevator. Theoretically this places the cp at 25% of the geometrical mean chord. This figure will be used in the following discussion.

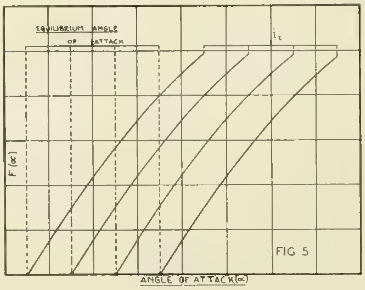

FIG 5

Rewrite equations (4), (5), and (6) as follows:

$$\left(\frac{W}{qS_w}\right)\sin^2\theta = \left[C_D + \left(\frac{2C_T}{J^2}\right)\left(\frac{D^2}{S_w}\right)\right]^2\ ....(4a)$$

$$\cos^2\theta = \left(\frac{qS_w}{W}\right)^2\left[C_{Lw} + \frac{S_t}{S_w}C_{Lt}\right].(5a)$$

$$C_{Lt} = \left(\frac{S_w c}{S_t d}\right)\left[C_{Mw} + \left(\frac{2C_T}{J^2}\right)\left(\frac{hD^2}{cS_w}\right)\right].(6a)$$

Eliminating θ and C_{Lt} by means of (5a) and (6a) we obtain, finally, an equation each side of which is a function of V and α; thus

$$F(\alpha, V) = \left[C_D + \left(\frac{2C_T}{J^2}\right)\left(\frac{D^2}{S_w}\right)\right]^2$$

$$= \left(\frac{W}{qS_w}\right)^2 - \left[C_{Lw} + \frac{c}{d}\left(C_{Mw} + \frac{2C_T}{J^2}\bullet\frac{hD^2}{cS_w}\right)\right]^2\ ......(11)$$

The last equation is easily solved graphically by plotting, on the same sheet, values of $F\,(\alpha, V)$, at constant α, versus V, for each side of the equation. If the intersections of corresponding lines of (the same) α are connected, as shown by the dotted line in figure 4, a curve of V versus α will be obtained. The true angle of attack of the tailplane at any given value of V, will then be obtained from

$$\alpha' = \alpha - \varepsilon + i_t$$

where ε is the angle of downwash and i_t the tail setting (both of the angles are referred to the wing chord).

The angle of glide (or dive) θ will be given by (4a) or (5a).

The tail lift coefficient C_{Lt} is given directly by (6a).

The elevator angle, δ is obtained from (7); that is

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(3) Munk, Max M., *Fluid Dynamics for Aircraft Designers.* The Ronald Press.

(4) Glauert, H., *Theoretical Relationships for an Aerofoil with a Hinged Flap. R. & M. 1095,* Aero. Research Committee, Great Britain.

(5) Pinkerton, R. M., *Analytical Determination of the Load on a Trailing Edge Flap. NACA TN 353.*

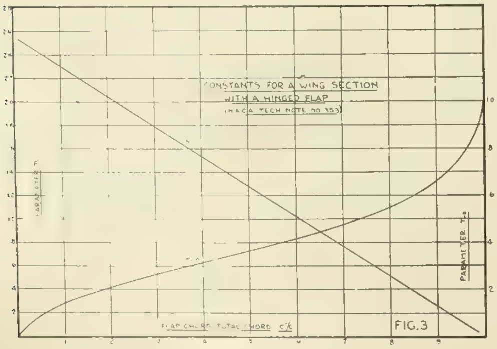


FIG.3

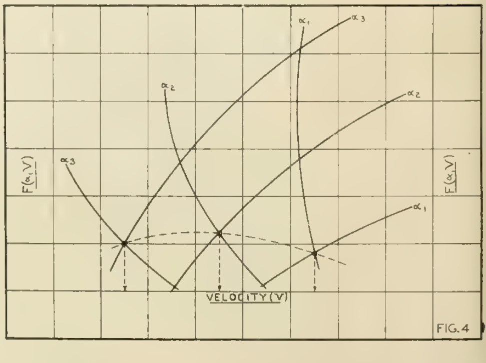


FIG.4

$$\delta = a_1/a_2\ [(C_{Lt}/a_1) - \alpha'] \ldots\ldots\ldots (12)$$

and is in degrees if α' is in degrees and a_1 is in absolute units per degree.

The case of a vertical dive at an arbitrary airspeed below the terminal, demands special attention, and is of considerable importance, because certain acrobatic maneuvers are executed from this initial condition of equilibrium. Aside, however, from the fact that V and $\theta\ (= -90°)$ are known, the remainder of the mathematical treatment is the same as for the terminal dive. When $\theta = -90°$ the lifts of wings and tailplane are equal and opposite. From equation (5a) we then have

$$C_{Lt} = -\ (S_W/S_t)\ C_{LW} \ldots\ldots\ldots\ldots (13)$$

and after substituting this value of C_{Lt} in (7) we obtain

$$\delta = -\frac{a_1}{a_2}\left[\left(\frac{S_w}{S_t}\right)\left(\frac{C_{Lw}}{a_1}\right) + \alpha'\right] \ldots (14)$$

for the elevator angle in a zero-lift dive. The values of C_{Lw} and α' are, however, as yet to be determined.

In the present case the effective moment arm of the tailplane is easily calculated. The distance from the leading edge of the mean chord (of tailplane) is

$$p = c_1\ [(1/4) + (m\delta/C_{Lt})]$$

If, then, r is the distance from the cg of the airplane to the leading edge of tailplane mean chord, the moment arm will be

$$d = r + c'\ [(1/4) + (m\delta/C_{Lt})] \ldots (15)$$

In the last equation substitute C_{Lt} from (13) and δ from (14)

$$\frac{d}{c} = \frac{r}{c} + \frac{c'}{c}\left[\frac{1}{4} + m\left(\frac{a_1}{a_2}\right)\left(\frac{1}{a_1} + \frac{\alpha' S_t}{C_{Lw}S_w}\right)\right] \ldots\ldots\ldots (16)$$

Another value of (d/c) is obtained from equations (6a) and 14):

$$\frac{d}{c} = -\left[\frac{C_{Mw}}{C_{Lw}} + \left(\frac{2C_T}{J^2C_{Lw}}\right)\left(\frac{D^2h}{cS_w}\right)\right] \ldots (17)$$

Equating (16) and (17) we have

$$\frac{r}{c} + \frac{c'}{c}\left[\frac{1}{4} + m\left(\frac{a_1}{a_2}\right)\left(\frac{1}{a_1} + \frac{\alpha' S_t}{C_{Lw}S_w}\right)\right] + \left[\frac{C_{Mw}}{C_{Lw}} + \frac{2C_T}{J^2C_{Lw}} \bullet \frac{D^2h}{cS_w}\right] = 0 \ldots (18)$$

Since (C_T/J^2) will have a fixed value at the known velocity V, this last equation is of the form $f(\alpha) = 0$. The solution is readily performed graphically. Simply plot values of the left-hand side of the equation (18) against angle of attack of wing cellule α, for various values of i_t (since it must be noted that $\alpha' = \alpha - \varepsilon + i_t$). The values of α for equilibrium in a dive, for various settings of the tailplane to wings, are given by the intersections of the curves on the α—axis, as shown in figure 5.

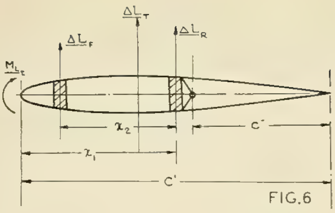
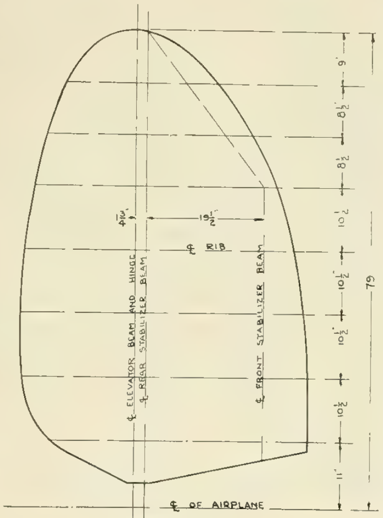


FIG.6



HORIZONTAL TAIL FIG.7

Knowing α for equilibrium in the zero-lift dive, the corresponding values of C_{Lw} and C_{Mw} are found by referring back to the wing cellule characteristics which are functions of α. The following quantities are then rapidly determined: (a) Tail lift coefficient C_{Lt} from equation (13); (b) Elevator angle δ from equation (14); (c) Moment arm of tailplane from (15); (d) Coefficient of load on elevator from (9) and figure 3; and (e) Elevator hinge moment coefficient from (10) and figure 2.

Another convenient method of determining the wing angle of attack in a zero lift dive, and which has been employed in the numerical example given at the end of this article, is to obtain the following value of δ (which is called δ_a) by eliminating θ, d and C_{Lt} from the general equations.

$$\delta = \frac{a_2}{a_1}\alpha'\left[\frac{A + (c'/r)(a_1/a_2)(m/a_1)}{1 + B}\right]$$

$$\text{where } A = \left(\frac{S_wc}{S_tr}\right)\left[\frac{C_{Mw} + \left(\frac{2C_T}{J^2}\right)\left(\frac{hD^2}{cS_w}\right)}{a_1\,\alpha'}\right]$$

$$B = \left(\frac{c'}{r}\right)\left[\frac{1}{4} + \left(\frac{m}{a_1}\right)\left(\frac{a_1}{a_2}\right)\right]$$

The value of δ given by equation (14) will be denoted by δ_b. If, then curves of δ_a and δ_b be plotted on the same sheet versus α, their intersection will occur at the wing angle of attack for zero lift on the airplane.

Assume that for tailplanes tapered in planform the lift coefficient is constant over the span. Then the intensity of spanwise loading is given by

$$dL/dy = q\,C_{Lt}\,c'$$

The variation of moment about the "aerodynamic center" of the element (quarter point of chord) is

$$dM_{c/4}/dy = qmc'\,\delta$$

and of elevator hinge moment

$$\frac{dH}{dy} = -\,q\,a_1\left(\frac{b_1}{a_1}\right)\left(c''\right)^2\left[\alpha' + \frac{b_2}{b_1}\delta\right]$$

$$= -\,q\,(c'')^2\,[b_1/a_1\,C_{Lt} + b\,\delta]$$

and of elevator load

$$dh_e/dy = q\,S_e\,[n_o\,C_{Lt} + n\,\delta\,]$$

When the stabilizer has two beams and the elevator is attached to the rear one with a number of hinges, we can obtain approximately the running loads on the beams by assuming that the shear load from the elevator is applied uniformly to the rear beam. Referring to figure 6, the reader may easily verify that the variation in front beam loading with span is then given by

$$\frac{dL_F}{dy} = \frac{1}{x_2}\left[\frac{dM_{Lt}}{dy} - \frac{dH}{dy}\right] + \frac{x_1}{x_2}\left[\frac{dL_t}{dy}\right]$$

and that of the rear beam by

$$\frac{dL_R}{dy} = \left[\frac{dL_t}{dy}\right] - \left[\frac{dL_F}{dy}\right]$$

To illustrate the foregoing methods, the magnitude and distribution of the air loads on the horizontal tailplane of an arbitrary staggered biplane, in a zero lift dive, will be calculated.

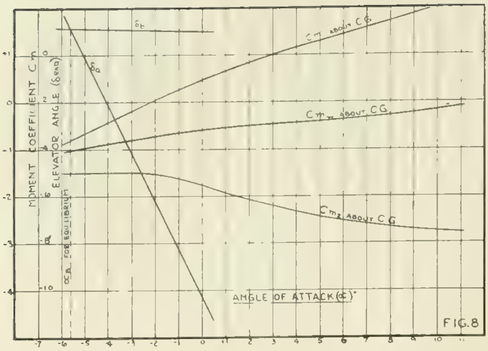
Numerical Example of Steady Dive Calculation

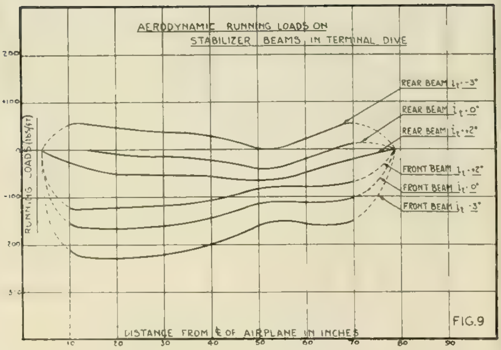
The characteristics of the airplane are:

Upper wing area	153 square feet
Lower wing area	131 square feet
Total wing area	284 square feet
Elevator wing area	16 square feet
Horizontal tail area	39.8 square feet
Aerofoil section	C-72
Span of tailplane	158 inches
Span of upper wing	33 feet 8 inches
Span of lower wing	30 feet 8 inches
Chord upper wing	58 inches
Chord lower wing	58 inches
Mean aerodynamic chord	58 inches
Gap	63.7 inches
Stagger	30 inches
Built-in incidence (upper & lower)	0°
Dihedral (upper & lower)	2°
Gross weight	3175 pounds
Radius of gyration (in pitch)	5.32 feet
Vertical distance from lower wing chord to MAC	38.2 inches
Tangent of stagger angle (=30/63.7)	0.471
Location of cg in (%) MAC	30.7 (%)
Equivalent monoplane aspect ratio	4.78
Propeller diameter	8 feet 6 inches

Terminal Velocity

Total drag coefficient $C_D = .063$ (in-





cluding propeller drag).

$$V = \sqrt{\frac{2 \times 3175}{.00238 \times 284 \times .063}}$$

$$= 386 \text{ ft./sec.} = 263 \text{ mph}$$

$$q = (\tfrac{1}{2})(.00238)(386)^2 = 177.5 \text{ lbs./ft.}^2$$

Lift Distribution in Biplane

α(bip.)	C_{L1}	C_{L2}	α_1	α_2	$(L/D)_1$	$(L/D)_2$
—5.992°	.009	.007	—5.99°	—5.99	0.47	.47
—3.879	.175	.137	—4.1	—3.6	9.66	9.66
—1.760	.342	.266	—2.1°	—1.0	16.1	5.50
.354	.507	.396	—0.2°	1.4	17.4	16.62
2.469	.676	.525	+1.7°	3.9	16.54	15.63
4.579	.843	.654	3.5	6.2	14.78	13.89
6.694	1.010	.785	5.4	8.7	13.12	12.24
8.806	1.170	.912	7.2	11.6	11.72	10.93
10.901	1.310	1.020	8.8	15.3	10.40	9.70
12.976	1.420	1.105	10.3	.	9.22	...
15.035	1.500	1.167	11.6	..	8.12	...
17.065	1.550	1.206	12.3	. .	6.75	...
19.050	1.530	1.190	...	.	...	...

Pitching Moment of Biplane About CG (Fig. 8)

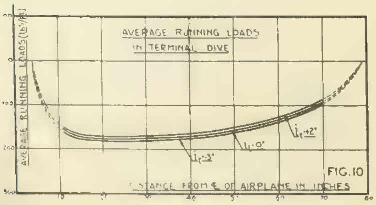
α(Bip.)	C_{M1}	C_{M2}	C_{Mw}
—3.88	+.040	.150	—.0906
—1.76	+.010	—.156	—.0666
.35	+.055	—.185	—.0556
2.47	+.094	—.212	—.0469
4.58	+.125	—.243	—.0447
6.69	+.153	—.256	—.0355
8.81	+.182	—.272	—.0270
10.90	+.213	—.277	—.0132

Angle of Downwash and Tail Angle of Attack

$$\varepsilon = 8.17 \ C_{Lw} \text{ (degrees)}$$

$$\alpha' = \alpha - \varepsilon + i_t$$

α(bip.)	ε	$\alpha'(i_t = 0°)$	$\alpha'(i_t = 3°)$
—3.88	1.29	—5.17	—8.17
—1.76	2.56	—4.32	—7.32
0.35	3.78	—3.43	—6.43
2.47	5.01	—2.54	—5.54
4.58	6.17	—1.59	—4.59
6.69	7.40	—0.71	—3.71
8.81	8.60	+0.21	—2.79
10.90	9.62	+1.28	—1.72



Geometrical and Aerodynamical Characteristics of Tailplane (Fig. 7)

y	x_1	x_2	$\frac{x_1}{x_2}$	C″	(C″)²	C′	$\frac{C''}{C'}$	$\frac{C'}{x_1}$	$\frac{C'}{x_2}$
11	2.25	1.62	1.384	1.18	1.39	3.58	.329	1.589	2.20
21½	2.24	1.62	1.378	1.60	2.56	3.98	.403	1.776	2.45
32	2.19	1.62	1.347	1.61	2.60	3.94	.409	1.803	2.43
42½	2.06	1.62	1.268	1.53	2.34	3.74	.410	1.816	2.30
53	1.82	1.62	1.122	1.40	1.96	3.36	.414	1.843	2.07
61½	1.48	1.10	1.340	12.4	1.54	2.85	.434	1.932	2.59
70	.98	.56	1.740	.97	.94	2.09	.463	2.140	3.72

The following tailplane properties are based on values given in R & M 1095:(4)

y	a_1/a_2	b_1/a_1	m	b	b_1/b_2
11″	1.452	—.105	.627	.525	.488
21½	1.333	—.119	.583	.454	.556
32	1.330	—.120	.579	.449	.559
42½	1.325	—.120	.577	.448	.560
53	1.317	—.121	.575	.445	.563
61½	1.295	—.124	.559	.426	.584
70	1.260	—.130	.534	.397	.610

Properties of tailplane which apply to tail as a whole:

$$c''/c' = .402, \quad a_1/a_2 = 1.34, \quad m = .584$$

$r = 13.52'$ distance from cg to LE of MAC of tail.

$$a_1 = \frac{(57.3)(.093)}{1 + \frac{1.70}{3.29}} = 3.52, \ c' = 3.17 \text{ in.}$$

Conditions of Equilibrium

	$i_t = 0°$	$i_t = +2°$	$i_t = —3°$
C_{Mw}	—.102	—.102	—.102
d	13.98	14.32	13.70
C_{Lb}	.0352	.0344	.0360
C_{Lt}	—.251	—.245	—.256
L_t	1770	1730	1810
L_w	1770	1730	1810
$\delta_{rad.}$	+.0435	—.0013	+.110

Elevator Hinge Moment

y	$i_t = 0°$	$i_t = +2°$	$i_t = —3°$
(Inches)	$2(\Delta H/\Delta y)$	$2(\Delta H/\Delta y)$	$2(\Delta H/\Delta y)$
11	—24.3	—12.3	—41.7
21½	—45.1	—26.0	—73.1
32	—45.6	—26.5	—73.7
42½	—41.1	—23.9	—66.4
53	—34.6	—20.2	—55.6
61½	—27.2	—16.3	—43.0
70	—16.7	—10.5	—25.7

The above values have been plotted (figure 11) and graphically integrated. The summation of the moments for each tail setting is as follows:

$$H(i_t = 0°) \quad = 198 \text{ ft.lbs.}$$

$$H(i_t = +2°) = 115 \text{ ft.lbs.}$$

$$H(i_t = -3°) = 318 \text{ ft.lbs.}$$

Knowing the elevator hinge moments we may now obtain the stick force. The gearing factor = 0.614; hence,

$$F(i_t = 0°) = .614\, H(i_t = 0°) = .614 \times 198 = 122 \text{ lbs.}$$

$$F(i_t = +2°) = .614\, H(i_t = +2°) = .614 \times 115 = 71 \text{ lbs.}$$

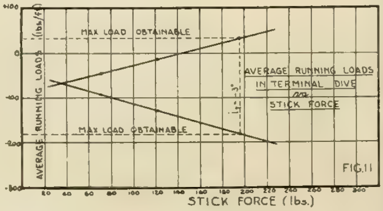
$$F(i_t = -3°) = .614\, H(i_t = -3°) = .614 \times 318 = 196 \text{ lbs.}$$

Inspection of the stick force values indicates that the average pilot can hold the subject airplane in the equilibrium position. We are now ready to distribute the tail loads and obtain the running loads on the stabilizer beams for each tail setting.

Running Loads on Stabilizer Beams

y	$i_t = 0°$		$i_t = +2°$		$i_t = —3°$	
	$\frac{\Delta L_F}{\Delta y}$	$\frac{\Delta L_R}{\Delta y}$	$\frac{\Delta L_F}{\Delta y}$	$\frac{\Delta L_R}{\Delta y}$	$\frac{\Delta L_F}{\Delta y}$	$\frac{\Delta L_R}{\Delta y}$
11	—160	1	—125	—31	—219	56
21½	—166	—11	—121	—52	—227	46
32	—159	—16	—117	—54	—217	38
42½	—141	—25	—104	—59	—194	24
53	—110	—40	—81	—65	—153	0
61½	—112	—15	—80	—44	—157	27
70	—103	10	—70	—21	—150	55

To obtain the average values of the front and rear running beam loads the results in the above table have been plotted (figure 9) and the average determined by integrating graphically. The average values are plotted in figure 10.



LIGHTER and STRONGER-
FASTER and SAFER . . .

FLEETWINGS "SEA BIRD" AMPHIBIAN

Stronger . . . and lighter by 200 lbs! Faster . . . and safer . . . permanently immune to corrosion . . . fire resistant up to 2000° F. The Sea Bird's designer, Mr. Carl de Ganahl, achieved these improvements by specifying U S S Stainless Steel for practically every part except motor and wing covers.

thanks to U·S·S STAINLESS STEEL

IT'S U S S Stainless Steel that makes the Fleetwings "Sea Bird" Amphibian lighter and at the same time stronger; faster and at the same time safer. The explanation? Just two simple facts . . .

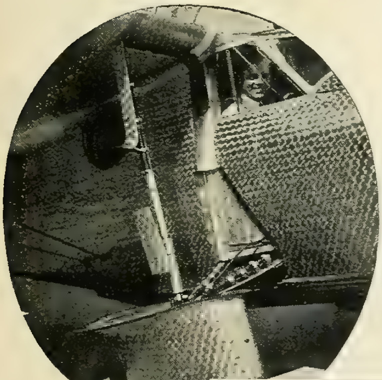
Of all metals available for airplane construction, stainless steel has by far the greatest strength-weight ratio. And of these metals, only stainless steel is truly corrosion-resistant—so truly corrosion-resistant that coatings or "clad"ings are never needed, that tarnish can never dim its brilliant surface.

Example: Since there can be no loss of metal by corrosion, the designer is free to use thinner sections extending further from their neutral axes . . . and these sections can be *closed*. Result: Light weight sections of tremendous strength.

Important, too, is the "Shotweld" process of stainless steel construction. Hull, fuselage and wing structure are made virtually one strong homogeneous metal unit. And with no rivet heads to interrupt the airstream, skin friction drops to a minimum.

Unquestionably, stainless steel is an ideal metal for airplane construction. To airplane designers and operators, it offers inviting, challenging opportunities to build new planes lighter *and* stronger; faster *and* safer.

For further information on the Sea Bird write Fleetwings, Inc., Bristol, Pa.; on the "Shotweld" process, write Edw. G. Budd Mfg. Co., Philadelphia, Pa.; on the properties and opportunities offered by U S S Stainless Steel, address the stainless steel specialist in our nearest district office.



Notice in these two views the interesting detail of the retracting landing gear. Notice also the exceptionally smooth, neat, rivet-less construction made possible by "Shotweld" fabricated U S S Stainless Steel. The metal surfaces need neither paint nor varnish.

U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

EDITORIALS

"The gratifying results obtained with materials attest the soundness of our policies and practices. Although much is still desired in material development, the airplanes and aviation equipment now supplied meet the particular needs of the fleet to a very satisfactory degree and make possible an extent and reliability of aircraft operation not obtainable in other navies."—REAR ADMIRAL A. B. COOK, U. S. Navy, Chief of the Bureau of Aeronautics.

Around The World Via The Air

● Visions of a trip around the world —by air all the way—became a reality last month as Pan American Airways forged the last link in the aerial chain which now girdles the globe. Inauguration of passenger service across the Pacific—on regular schedule—brought realization of a goal which stands out as one of the industry's greatest accomplishments.

More than the fact that one can travel around the world entirely by air is the part American aircraft is playing in making the trip safe, comfortable and dependable. For today, if the traveler desires, he can go "American" practically 90% of the 25,000 miles.

The epochal trip by reporter H. R. Ekins of the *World-Telegram*, was not a stunt, although it proved that if one really wished to he could fly around the world in 18½ days at a reasonable cost. The trip was a tremendous boost to aviation, and particularly to American aviation. His flight, fast as it was, was found to be safe and entailed a minimum of inconvenience. It was a world-publicized show of American achievement in the science of aviation, for the only non-American vehicle used was the German zeppelin *Hindenburg*, which became known so favorably to Americans during the past season.

To American aircraft, engine and accessory manufacturers, world flights by regularly scheduled air transports are a tribute to their engineering ingenuity and foresight. The accomplishments of the pilots, ground crews and technicians who have already pioneered the route across the Pacific and will pioneer another across the Atlantic excite the admiration of the world.

Feeder Lines Need Expansion

● The air transport map of the United States shows transcontinental and other lines, serving more than 200 large cities, criss-crossing the country, but it also reveals wide open spaces where scheduled air service has not yet penetrated and where cities have yet to experience the benefits of a regular air service.

Expansion of existing routes has just about reached the maximum and further substantial development must come from feeder lines. Some efforts to supply this rapid-growing necessity are being carried on by a few fixed base operators who make connections with a few planes on some of the major or minor routes. These efforts, however, are disorganized and lack the business-like procedure usually associated with regular air transport operations. Yet, demands for air travel cannot be confined to large cities, and small industrial areas are entitled to the service they feel they must have to meet competition from those cities now enjoying air service.

Recently the Aviation Division of the American Legion recommended the establishment by the government of feeder lines to outlying communities through independent operators to build up air mail and express traffic to the major trunk lines. Their action indicates growing recognition of the lack of complete service in this field. There must be further agitation from many other sources for the establishment of these feeder lines.

Feeder line service must come. Its inauguration and scheduled operation—by independent or the established airline operators—is preventing air transportation from extending its helpful hand to every community in the country.

Airplanes To The Rescue

● Two mercy flights last month made the newspaper headlines. In one, an airline was involved; in the other, military aircraft performed an outstanding rescue.

In spite of the delays occasioned by weather and missed connections, airline operators continually strive to maintain schedules at all costs. But when a Chicago & Southern Airlines' Lockheed reached St. Louis one day last month the ship was ordered to speed non-stop to Chicago, passing up a stop at Springfield, where a special plane was dispatched to pick up the passengers waiting there. The reason was an 8-month-old child in the cabin slowly choking to death with an obstruction in its throat. Only in Chicago were there the doctors and facilities to save the child.

On the Java Sea, a passenger ship suddenly capsized. Hundreds were thrown into turbulent waters. British and Dutch flying boats hastened to the stricken survivors, picked up more than 50, and then returned to their bases without further ado. It had been considered in the nature of a job to be done.

Incidents such as these built good will which offsets to some degree the aimless publicity flights which clutter up the newspaper headlines all too frequently.

Out-Of-Date Regulations

● Section 74E of Dept. of Commerce Bulletin 7-A, *Airworthiness Requirements for Aircraft*, specifies that "all airplanes shall be able to recover from a 6-turn spin in no more than 1½ additional turns . . ." and that "an airplane of more than 4000 pounds gross weight will not be subjected to the spin test unless the flight characteristics of the particular plane are . . . such as to indicate the advisability of a spin test."

Most engineers concede that the lateral weight disposition on any multi-engined aircraft is such that the full load spinning characteristics would not be within the requirements set down for the equivalent single engined ship. In fact more of them would be vicious spinners, yet, under the present requirements, manufacturers of small bi-motored airplanes which weigh less than 4000 pounds gross, would be called upon to prove that the opinions of most engineers are wrong.

If it is assumed that it was a physical impossibility for any twin-engined plane, regardless of weight or size, to spin correctly, then manufacturers in this country must resign themselves to the fact that they can never produce a twin-engined airplane of less than 4000 pounds gross.

This is incongruous, to say the least. Manufacturers are not desirous of producing an "unsafe" airplane. The small bi-motored airplane represents a different type of aircraft—one that will be flown differently and for different purposes. It will hardly be used for stunting and is unlikely to be flown by inexperienced pilots—rather it will be flown by more nearly professional pilots than the single-engined commercial airplane.

Adherence to out-moded rules and regulations means progress in certain new and useful designs will continue to be retarded. Surely we need a good housecleaning in that beautiful and spacious building on Pennsylvania Avenue.

HAMILTON STANDARD *Controllables*

ON NEW BASIC TRAINERS

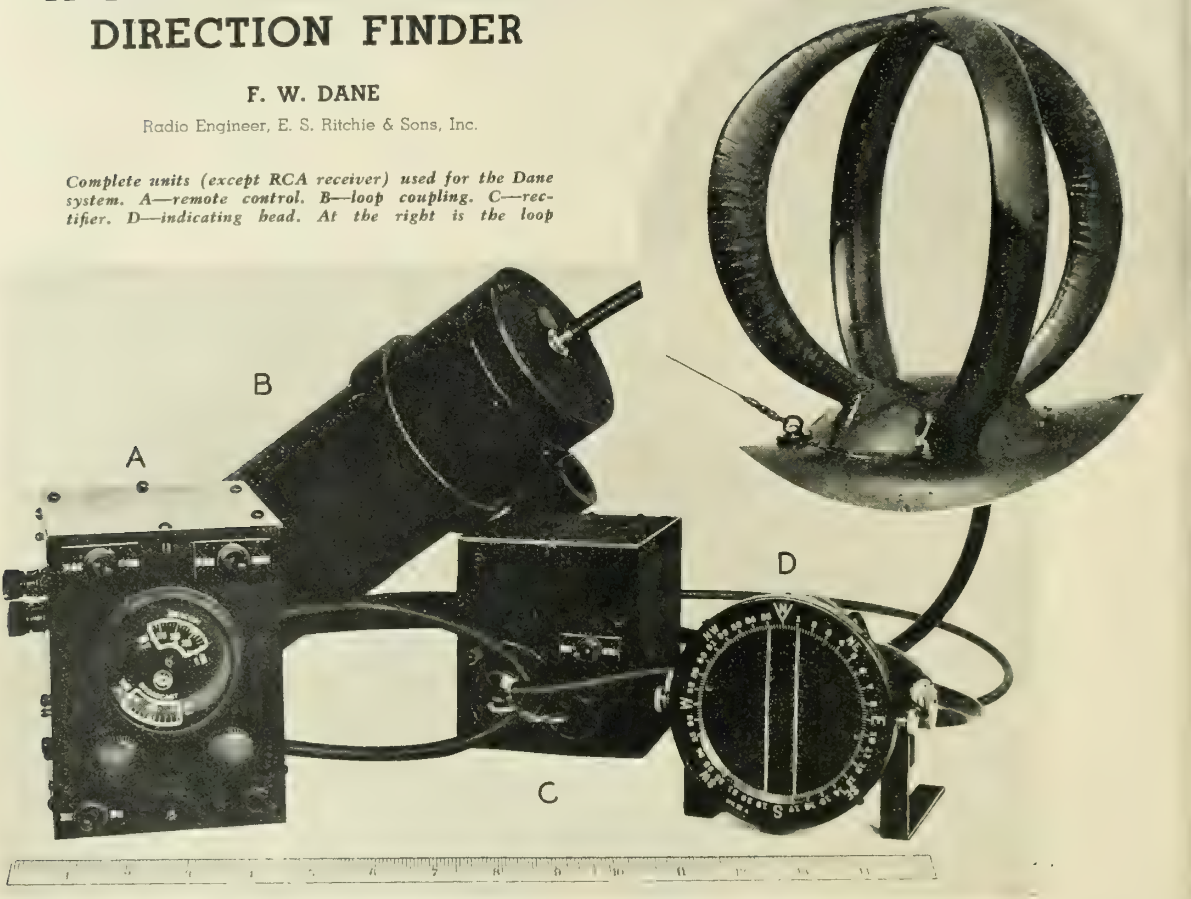
To acquaint army student-pilots with an important feature of high-performance aircraft, the new basic training ships of North American and Seversky are now equipped with Hamilton Standard Controllable Pitch Propellers . . . further evidence of the widespread use of the controllable pitch principle.

HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT CORPORATION

A NEW VISUAL RADIO DIRECTION FINDER

F. W. DANE

Radio Engineer, E. S. Ritchie & Sons, Inc.



Complete units (except RCA receiver) used for the Dane system. A—remote control. B—loop coupling. C—rectifier. D—indicating head. At the right is the loop

● Radio direction finders now in use can be divided into two broad classes—those which can be used as homing devices, and those which permit cross bearings to be taken during flight.

Both types have their advantages, but operation of the first is limited to airports which are equipped with transmitting facilities. The second system is a somewhat more accurate method of navigation. The rotatable loops employed, however, cannot always be conveniently fitted to all types of aircraft and it has been found that sharp, accurate bearings cannot always be taken due to the changing position of the loop in relation to the different surrounding parts of the aircraft.

There apparently, then, is a need for an instrument which, mounted on the plane's panel board, will give constant visual indication in degrees to any known radio transmitter which would be absolutely automatic as long as the receiver is tuned in to that station. Also it would be so designed that any defect which may develop in either the transmitter or receiver would be indicated, thus overcoming the possibility of the reception of inaccurate bearings.

The Dane Visual Radio Direction Finder is a visual-indicating system which can be used not only as a homing device, but also for taking cross bearings. It operates directly from the carrier of any radio transmitter, and has been designed especially to operate from broadcast stations and airport transmitters in the frequency range between 1500 and 250 kilocycles.

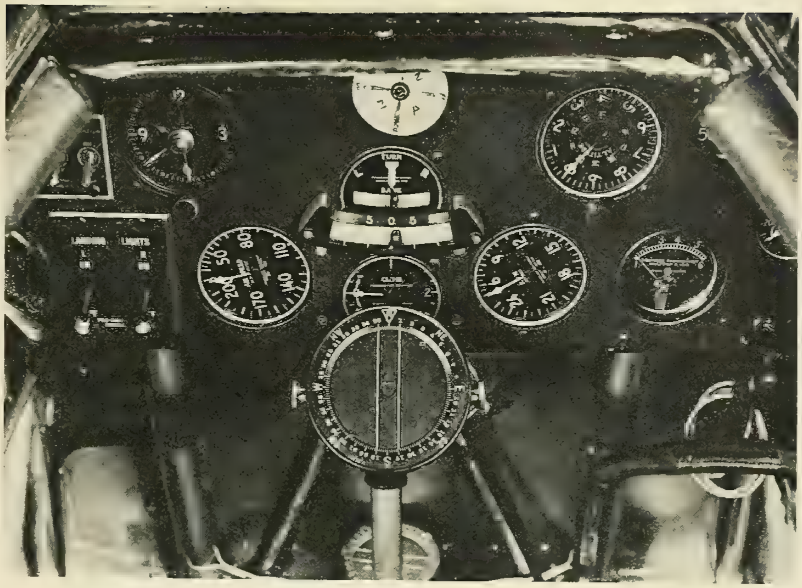
In operation, the transmitter is represented by a small spot of light on the indicating scale. This spot gives, in degrees, the exact position of the transmitter in relation to the course of the aircraft. By setting the outer degree scale of the indicator to correspond to either the magnetic compass or the directional gyro reading, the bearing of the transmitter is given in direct relation to either of these.

This direction finder allows homing on any suitable transmitter, and provides an arrangement for allowance to be made for the angle of drift. After coordinating the indicator bearing with the directional gyro, the known angle of drift can be taken into consideration in the following manner: if the aircraft is heading exactly toward the transmitting station, the spot of light, giving the transmitter position relative to the aircraft's course, will be over the zero mark of the indicator scale. As long as the aircraft holds its course, the indicator will read zero. Any deviation to the right or left will be shown immediately by the indicator spot swinging through the precise angle which the aircraft has swung.

If a cross wind is blowing, the angle of drift may be used for reference instead of the zero mark on the indicator scale. For example, should the pilot wish to allow for a 10° drift to starboard, he swings the craft until the spot of light is over the 10° marking, and in this, the aircraft follows the shortest track to the airport instead of the long curving track, finishing up-wind. Should the pilot desire to check his exact position along his course, he can retune the receiver to any other transmitter that he can identify, and then switch to the visual indicator. The spot of light then appears over the scale, remains steady, and thus shows the bearing of that station in relation to the course.

When the aircraft is flying on a regular route, the cross-bearing operation may be simplified, for after determining and flying on his "homing" course, the pilot can retune the receiver to a station lying to the right or left of course. A line drawn from that station intersecting that course at right angles, will give a point at which an angle of 90° will be shown on the indicator. The pilot then tunes in to this check station some minutes before arriving, and watches the angle on the indicator increase from, say, 75° to 90°. On passing the point of intersection of the course, and the right angle line drawn through the course, the angle shown by the indicator will increase as the station falls astern.

This instrument has been so designed that should the transmitter or receiver units fail in operation a visual indication in the form of a circle of light immediately appears upon the indicator, thus eliminating any possibility of error in the bearing. This circle of light appears for the short space of time that the aircraft is over the transmitter, and in the cone of silence.


Dane direction finder installed on an airplane instrument panel

Systems, operating on the aural-null principle, show sensitivity to atmospheric electrical disturbances. However, during tests of the Dane instrument, it was discovered that its operation could be carried on through thunder storms, the only effect being a reduction of the intensity of the indicator light rather than a complete blotting out of the bearing of the station.

Tests of this instrument installed in a plane have been conducted since November, 1935, without special receiver equipment. On these tests, the RCA AVR7 remote-controlled receiver has been used after making only slight electrical changes. The system consists of two electrostatically shielded fixed loops mounted at any convenient location on the aircraft and connected to a coupling unit which supplies the means of joining correctly to the receiver by way of the remote control unit. The output of the receiver is impressed on the rectifier unit which in turn supplies the necessary energy for operation of the indicator. The streamlined electrostatic shielding of the loops not only assures good reception during conditions of rain, snow, ice, and fog, but also minimizes drag. The total weight of the complete direction finder, including the loop and receiver, is 39 lbs. 10 oz. The current draw of the system at 12 volts with type AVR7 receiver is 4.1 amps.

This system lends itself to a number of methods of blind flying. For example, when nearing its destination, a pilot could tune out the "homing" transmitter and tune in two or more low-power landing transmitters conveniently placed with relation to the wind direction. They would impress a pattern on the indicator scale which would show the exact relation of aircraft to the airport. In short, this instrument gives accurate visual bearings in degrees, automatically indicates defects in either the transmitter or receiver, and permits a degree correction for drift. Since the indicator works continuously and automatically, eliminating the necessity for taking a series of readings at intervals, the pilot may regard it as he would his compass or directional gyro.

Digest of Technical Articles from Foreign Publications

Aerodynamics

Experiments on a Small-Chord Flap on a Clark YH Aerofoil in the Compressed Air Tunnel; D. H. Williams, B.Sc., and A. F. Brown, B.Sc., of the Aerodynamics Dept., N.P.L.; Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1681, *May*, 1935.

Experiments presented in this report were conducted to determine the scale effect on a flap, of 1/20th chord width, inclined at different angles to the main part of an airfoil of Clark YH section.

Flap angles were varied from 0 to 25° at values of Reynolds Number of 0.3, 0.8, 2 and 4 millions approximately.

The rate of increase of lift with flap angle diminishes as the flap angle increases. The increase in lift due to flap angle increases with increasing Reynolds Number, rapidly between RN=0.3 and 0.8 millions and then more gradually up to a value of RN somewhat higher than the highest used in the experiments.

Elasticity

Torsion of thin-walled cylinders with diaphragms (Calcolo a Torsione dei Cilindry Cavi a Parete Sottile Molteplicemente Connessi; Dr. Ing. Carlo Riparbelli; L'Aerotecnica, Volume XVI, N6, Giugno 1936).

In view of its importance in aircraft design, the problem of torsion of thin-walled type of structures has been extensively treated. The present paper is an extension of formulas by Bredt, the author showing their application for cellular type of cross-sections and developing formulas permitting the calculation of stresses, torsional deflections and the position of the elastic axis. The usual limitations and assumptions are accepted in this study, namely, the lack of fixity of end planes of the cylinder and absence of local failures due to elastic instability. The practical application of the method is illustrated by a numerical example. As observed by the author the experimental verification is within 10 to 15%, which is ample considering the complexity of the problem and the simplifying assumption inevitable in a practical solution.

Aerodynamics

The Action of Wind on Buildings (L'Azione del Vento Sulle Costruzioni; Dott. Ing. Renato Giovannozzi; L'Aerotecnica, Volume XVI, N6, Giugno, 1936).

Study of the action of wind on buildings is made by the author both from theoretical and experimental viewpoints. He summarizes and discusses principal data available on the subject and derives formulas which provide means of calculating the air forces arising as a result of wind. Part I treats the general problem, presenting the theoretical basis of the method, effect of the roughness of the ground, internal pressures; Part II treats the case of trussed structures such as bridges, high tension towers, etc.; Part III is devoted to solid wall structures such as buildings, roof effect, etc.

The article condenses and generalizes a considerable amount of experimental data and at the conclusion gives a three-page bibliography (98 references) on the subject from American, British, Italian, French, and German sources.

Vibration

Investigations of the Problem of Vibration of Aircraft (Indagini Sulle Vibrazioni Dei Velivoli, Capt. G. A. Carlo Minelli L'Aerotecnica, Volume XVI-N5, Maggio, 1936).

The General Council of Aircraft Constructions has initiated a thorough study of aircraft vibrations to undertake an intelligent investigation of this problem at the experimental laboratories in Guidonia. For the present, the study follows purely theoretical lines indicated by Blenk and Liebers. The complexity of the problem makes it necessary to restrict the present analyses to the limited type of vibration phenomena such as flexural-torsional, torsional-aileron, flexural-aileron. The studies neglect aerodynamic damping, variation in characteristics due to movement, etc. The article is the first of the series and presents the case of torsional-aileron vibrations taking into account the effect of distributed weights along the wing span. A criteria is developed for torsional dynamic stability of the wing structure and the dynamic equilibrium of the aileron. The next article will treat the case of flexural-aileron vibrations.

Cooling

Ducted Radiators, The Theory of Low-Velocity Cooling, with a Basis for Calculating the Drag, F. W. Meredith, B.A., Aircraft Engineering, Vol. VIII, No. 90, *August,* 1936.

This paper is an extension of RM 1683 *Notes on the Cooling of Aircraft Engines with Special Reference to Ethylene Glycol Radiators Enclosed in Ducts.* Unlike our American approach where turbulence is accepted and considered a desirable feature for proper heat transfer, the British feel that greater benefits can be derived from low-velocity streamline flow. It is evident that were it possible to dissipate the proper amount of heat such an arrangement would result in lesser cooling drag and would be more preferable to our accepted notion. The ideal system as specified by the author must possess the following characteristics: (a) it must avoid stream separation or severe expansion; (b) it must reduce the stream velocity over the cooling surface; (c) it must reduce the external surface to a minimum. The drag of the cooling system is divided into three categories—stream friction drag of stream flow; drag due to eddying dice to separation; and drag due to eddying due to expansion. Meredith states that the second and third can be avoided by proper streamlining while the first can be reduced by the reduction of the air stream velocity or cooling area affected. The article is brief, clear and in addition to directly applicable information, contains considerable food for thought.

Thermodynamics

Heat Dissipation of Ethylene Glycol Radiators and Comparison with Water Radiators. C. Anderton Brown, A.M.I.Mech.E., and F. G. Barlow, B.Sc., Air Ministry (Great Britain), Aeronautical Research Committee Reports and Memoranda No. 1696, *July* 26, 1935.

With the object of improving aircraft performance with liquid-cooled engines, liquids of higher boiling point than water may be used. Ethylene glycol has been employed for this purpose. Experiments with engines have been made but the influence of coolants other than water on radiator performance has not been sufficiently investigated. This report presents radiator design data for such coolants.

Under conditions of present tests, it was found that the heat transfer of liquid to air, per unit frontal area per degree temperature difference at 100 ft. sec. was from 6% to 8% less with ethylene glycol than with water. This arises from inferior heat transfer from liquid to metal, and the reduction of mass air flow at higher metal temperatures.

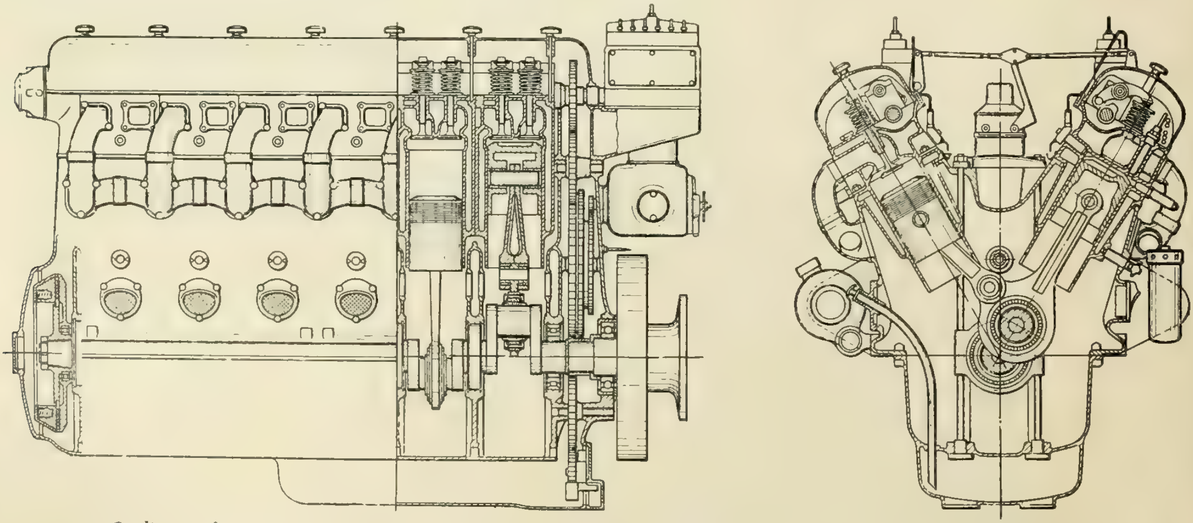
The comparative sizes of radiators with water and with any other coolant of known physical properties can be calculated from the estimated metal temperatures, the basis of the calculation being a water radiator with similar tubes and having a known performance. From the example worked out, ethylene glycol, at a maximum temperature of 125°C., permits a large reduction of radiator area (about 50%) on account of the higher working temperature and the greater proportionate direct heat loss from the engine jacket, pipes and tankage. The percentage of jacket hp. dissipated apart from the radiator tube block becomes a material factor in the calculation, and substantially improves the prospects of cooling by high temperature coolants.

Where high temperature coolants are employed the question of radiator solders is important as the strength of lead-in solder is reduced with increased temperature.

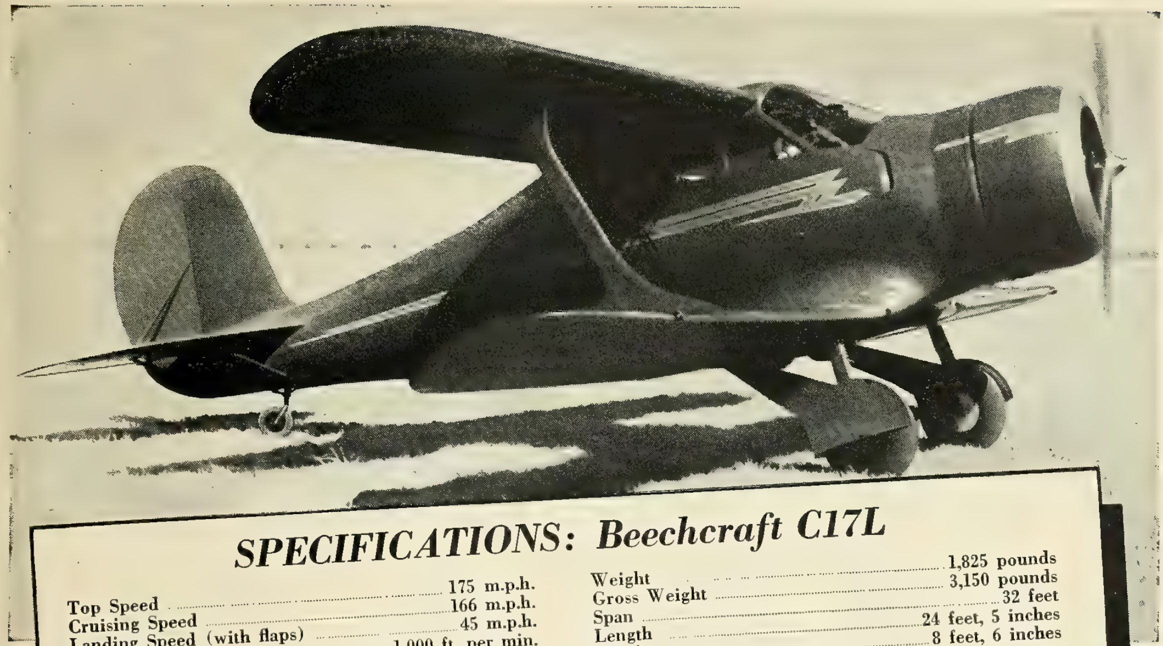
Design

Rational Design of High Speed Aircraft, F. G. Glass. N. E. Joukowski's Central Aero-Hydrodynamical Institute, Technic of the Air Fleet, Numbers 7 *and* 8-9, *July and August-September,* 1936.

The problem of design prerequisites of high speed aircraft is approached in this paper from an analytic study supplemented by a review of available experimental data. At the outset, discussing general requirements, the author restricts the specifications to a natural condition of a fixed landing speed. The treatment of the subject is broad and novel, although it suffers from a certain tone of finality in many still open issues. A number of conclusions and remarks are, however, worthy of a close scrutiny. Discussing the subject of a suitable engine the author makes a statement on a point apparently sufficiently appreciated in Europe, but unfortunately lately sadly neglected by us: that aerodynamics of an engine predominates its power. Europe is definitely abandoning radial air-cooled engine—at least for the present—and is seeking a solution of aerodynamically economic cooling. European liquid-cooled engines have been sufficiently perfected so that they develop power which enables the achievement of speeds unobtainable with even a two-row radial engine. Mr. Glass gives a searching discussion on interference, treating the question of disposition of wing and body, wing and tail surface, fillets, mutual interaction of vertical and horizontal tail surfaces, etc. Next comes the choice of the wing and wing mechanics—flaps. In this connection, the author describes the Russian airfoil BS for which he claims a drag 15% lower than for the NACA 22 series. BS is a biconvex, reflexed airfoil with a sharp nose. After a fairly extensive presentation of flap data, the article is concluded with a comparative experimental study of aileron behavior in connection with BS profile equipped with a modified split zap flap.



Outlines and sections of the 410 hp Maybach Type GO 5 airship diesel engine described in the September "DM-Z"



SPECIFICATIONS: *Beechcraft C17L*

Top Speed	175 m.p.h.	Weight	1,825 pounds
Cruising Speed	166 m.p.h.	Gross Weight	3,150 pounds
Landing Speed (with flaps)	45 m.p.h.	Span	32 feet
Climb	1,000 ft. per min.	Length	24 feet, 5 inches
Service Ceiling	15,000 feet	Height	8 feet, 6 inches

Plus Goodrich Low Pressure Silvertown Tires, Goodrich Gasoline Hose, Rubber Tubing and Rubber Cements

BEECHCRAFT BUILDS FOR EXTRA SAFETY AND COMFORT WITH DEPENDABLE GOODRICH PRODUCTS

COMPLETE specifications of the new Beechcraft C17L reveal far more than its speed and snappy performance. These new Beechcraft are built *ruggedly* from quality standards. 12 coats of quality finish on the wings . . . the use of Goodrich Rubber Tubing, Rubber Cements and Goodrich Gasoline Hose are some of the *tested* construction features that mean economy and "trouble-free" service for Beechcraft owners. Matching automobile economy, the new C17L actually gives better than eleven miles per gallon of fuel.

And, of course, Beechcraft plays safe on tires. Even though this new plane lands as slowly as a training plane—even though it has all the landing advantages of oleo gears—Beechcraft takes the final precaution of equipping with Goodrich Low Pressure Tires. Not only because this type of tire is *safest* in difficult places but no other type of tire can match its real landing gear "softness."

Goodrich Products All-Purpose

Remember, Goodrich Aviation Equipment covers the entire range of aviation's rubber needs. In addition to Goodrich Airplane Silvertowns there are more than 40 other Goodrich products—everything from dependable deicer equipment to tiny grommets—that will increase the safety, efficiency and comfort of your planes. Follow the lead of the leading pilots, plane makers and air lines. Specify "Goodrich." See your nearest Goodrich dealer or write now to Dept. 624, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information.

BEECHCRAFT C17B. A high performance, economical plane that is a 1936 favorite with sportsmen, pilots and executives everywhere. *Goodrich-equipped for extra safety, comfort and efficiency.*

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.

HYDRAULIC-ELECTRIC DYNAMOMETERS

E. C. WISE

Industrial Dept., General Electric Co.

● During recent years aircraft engine speeds and capacities have increased far beyond the dynamometer testing facilities available in the majority of laboratories. The electric machines which, prior to the war, were entirely adequate for most engines have been outgrown in capacity from three to four times, and speeds have likewise increased to such an extent that many of the electric dynamometers in use no longer permit complete tests up to the maximum engine speeds.

Several years ago, in fact, it became apparent that to meet the increased torques and speeds of the newer engines it was no longer practical to build an electric machine which possessed the required torque capacity and at the same time could be operated at peak engine speeds. It was therefore necessary to devise a combination hydraulic-electric equipment possessing the almost unlimited torque capacity of the hydraulic dynamometer with the ability of the electric dynamometer to operate as a motor for the purpose of cranking the engine and determining friction losses.

Such equipment was soon developed, having an absorption capacity of 1000 hp and a motoring capacity up to 200 hp with a maximum operating speed of 2500 rpm. These ratings, although adequate for the majority of present-day engines, possess little margin for future developments.

Now, with an eye to the future, several of the leading engine builders have installed combination equipments with absorption capacities as high as 2900 hp Each of these equipments is composed of a multiple-blade hydraulic dynamometer good for an absorption rating of 2500 hp and an electric dynamometer of 400 hp. The electric unit delivers 300 hp as a motor over a range of 1000 to 3000 rpm when operating from a 250-volt d-c supply and, for short periods, as high as 400 hp can be obtained by increasing the applied voltage. The absorption capacity of the combined unit at 1000 rpm is slightly over 1600 hp. Combination sets of this description have been built in capacities as high as 2000 hp at 1000 rpm and 3500 hp at maximum speeds of 2500 and 3000 rpm, the equipment in all cases having a safe mechanical strength to operate up to 3500 rpm engine diving speed.

Both the hydraulic and electric dynamometers are trunnioned in ball-bearing pedestals which in turn are mounted on a common cast-iron base assuring a rigid structure beneath both machines and preserving the alignment and sensitivity of the trunnion mounting.

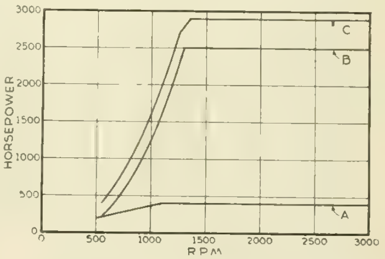
Torque frames rigidly strap the housing of the hydraulic unit to the magnet frame of the electric unit and a flexible coupling connects their rotors. The combined torque reaction on both machines is measured by a single automatic dial scale which is connected to the magnet frame of the electric machine through a reversible torque-linkage mechanism, the latter converting the reaction on the frame to a downward pull on the scale regardless of the direction of rotation.

The scale head and mechanism are of the springless type and have an additional feature that provides remote indication. This is accomplished by what is known as Selsyn (self-synchronizing) equipment which permits a mechanical motion to be transmitted electrically to a remote point where it is again converted to a mechanical motion that duplicates the original. In the new dynamometer equipment, a Selsyn transmitter is coupled directly to the indicating pointer shaft of the scale head and connected electrically to a Selsyn receiver and scale head located in the engine control room, thus permitting observation of torque readings at a point convenient to the operator.

Since the electric dynamometer must operate at speeds much higher than the usual d-c motor or generator, a commutator of the shrink-ring type and windings with special wedges and binding wire are employed to withstand the resulting high centrifugal forces. A barrel-type rolled-steel frame fully covers all the rotating parts. Grease-lubricated ball bearings of an especially selected type for high-speed dynamometer service are used. Electrical connections are made through unusually flexible ribbon cable, assuring freedom of the frame to rotate in the pedestal bearings so that accurate and sensitive registration of torque is afforded.

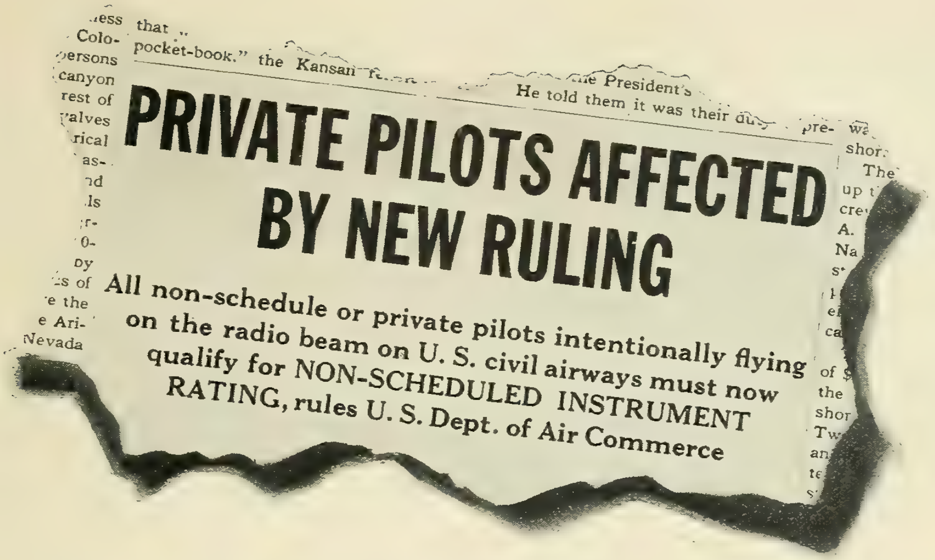
The hydraulic dynamometer consists of a multiple-disc rotor and housing. Water

(*Continued on page* 86)



Curves of horsepower-absorption capacity for combination hydraulic-electric dynamometer equipment. A = maximum capacity of electric unit, B = hydraulic unit, C = combination machine

Main contactor panel in resistor room (left) and remotely-operated master control panel (right) for G.E. combination hydraulic-electric dynamometer equipment of 2900 hp capacity (center) in the Pratt & Whitney plant, East Hartford



PRIVATE PILOTS AFFECTED BY NEW RULING

All non-schedule or private pilots intentionally flying on the radio beam on U. S. civil airways must now qualify for NON-SCHEDULED INSTRUMENT RATING, rules U. S. Dept. of Air Commerce

BOEING SCHOOL'S NEW COURSE PREPARES YOU!

"Non-scheduled Instrument Rating" course . . . this special training gives in minimum time the instrument ("blind flying") experience which Private, Limited Commercial, and Transport pilots need to meet the new Air Commerce instrument rating requirement

As a division of United Air Lines, Boeing School has been a pioneer in the development of instrument and radio beam flying technique.

Since 1930, instruction in a hooded cockpit has been included in the school's curriculum. All students in Boeing School "Airline Pilot" and "Airline Pilot Operations" courses have been receiving it as a part of their regular course of study.

Thus at Boeing School you study under seasoned veterans in "blind flying" instruction—government-licensed experts in *practice* as well as theory.

You practice in a Boeing 203 instructional plane, 2732 pounds, powered with a 215 horse power engine. Instruments used include regular plus turn and bank indicator, sensitive altimeter, rate of climb indicator, watch (large second hand), air speed indicator, radio-phone and directional beam receiver. While under the hood you take off, execute required maneuvers, determine positions, locate the airport beam, and make approach to the field for landing. At the end of your course of study a completion test is given by the U. S. Dept. of Commerce.

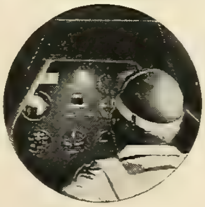
How long does it take?
How much does it cost?

The Air Commerce regulation sets a minimum of 20 hours instrument flying instruction and practice before you can apply for rating. On the basis of two flights a day you can complete Boeing School training in about three weeks time. Individual instruction is given at a flat rate of $20 an hour—a minimum total cost of $400. For full details write or wire today to *Boeing School of Aeronautics, Dept. S-11, Airport, Oakland, California.*

United officials form School Flight Advisory Board

The success of instrument flying and other flight training at Boeing School is in no small measure due to the close cooperation of E. P. Lott, Chief of Flying, and the three men pictured above: Walter Addems, Eastern Chief Pilot; W. D. Williams, Mid-Western Chief Pilot; H. T. Lewis, Western Chief Pilot. These United officials form the Boeing School Flight Advisory Board

Hooded cockpit of Boeing 40-C—one of the 5 school planes completely equipped for instrument and radio beam flying instruction



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Department S-11, Airport, Oakland, California.

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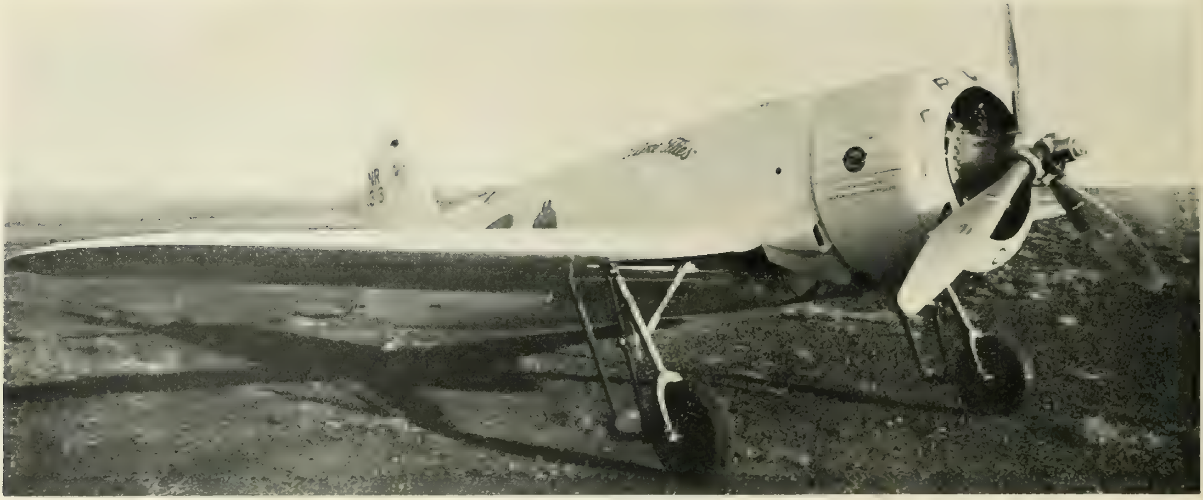
- ☐ Airline Dispatching & Meteorology (two years college required)
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Home Study Courses (For those in the industry)

*Name*__________ *Age*______

*Years in High School*______ *Years in College*______

*Address*__________ *Phone*______

*City*__________ *State*______

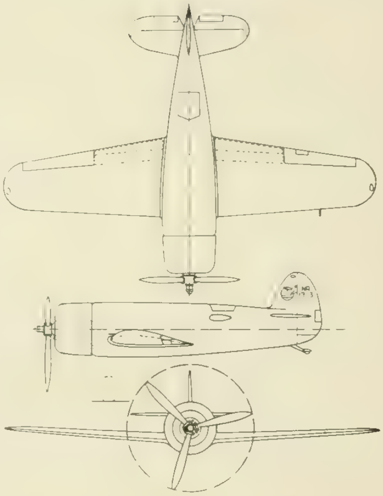


FRANK HAWKS' SPEED PLANE

● The semi low-wing cantilever monoplane built by Hawks Aircraft of Redding, Conn., under the sponsorship of the Gruen Watch Co., for Frank Hawks, utilizes practically every proven modern device for safety and the proper operation of high speed aircraft. This airplane has been designed by Hawks and Howell Miller to obtain the high speeds of a racer as well as the practicability of a modern light transport plane. Known as *Time Flies*, the plane is powered with an NACA-cowled P&W Twin Wasp R-1830 BG engine which develops 1150 hp, and which is expected to give the plane a cruising speed of 340 mph and a maximum speed of 375 mph. A 3-bladed Hamilton Standard constant speed propeller is provided.

Fuselage construction is of Summerill chrome molybdenum steel tubing, covered with Haskelite plywood. The plywood-covered cantilever wing has three spruce spars boxed with plywood, has plywood ribs and maple corner blocks. Interior structure of the fin is steel tubing with plywood ribs, and stabilizer, rudder and elevators have spruce spars, maple corner blocks and plywood ribs. Box-type construction is used in the tail group, all of which is covered with plywood. The rudder fairs into the fuselage and is equipped with a trimming tab, operated from the cockpit. Elevators and ailerons also are provided with trim tabs, and the Grimes landing lights are retractable.

Landing gear is of the individual leg type equipped with Goodrich tires, Hayes hydraulic brakes and *Aerol* landing gear struts. It is fully retractable through manual operation, the wheels retracting into wells in the underside of the wing and fuselage belly. The tail skid is streamlined by a form made of aluminum in its upper part and at the bottom of *Sta-Light*, a substance for protecting metals subjected to excessive wear. Within the streamlined form is a small wheel which protrudes sufficiently so that the wheel carries the load when landing on an asphalt or concrete runway. On softer fields, the landing shock is taken by the lower part of the skid.



A 230-gal. fuel tank is carried forward of the cabin, and just aft of the engine, behind a metal fire-wall, is an oil tank with a capacity for 25 gals.

Streamlining throughout has been enhanced by the elimination of the windshield or conventional hatch cabin. The cabin conforms to the lines of the fuselage with ample window lights on each side and on the top surrounding the cabin, the lights, of safety glass, being faired into the lines of the fuselage. In flight the pilot has flying vision through top and side windows. Entrance to the cabin is through a side door, which can be instantly dropped in an emergency by a trip control which releases the hinge pins.

For landing and taking off, the seat may be raised by a manually-operated hydraulic jack. In the raised position, the pilot's head is above the line of the fuselage to give wide vision ahead and to the sides. The top window light is hinged at its forward edge and geared to the jack so the window raises and forms a conventional windshield when the seat is raised.

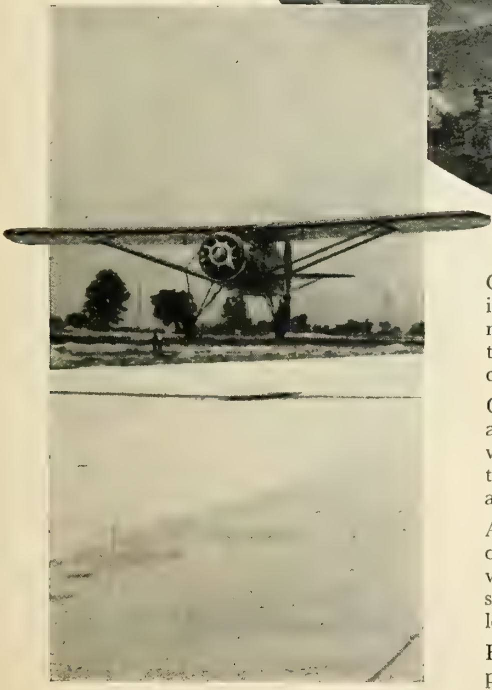
In flight, the seat is lowered and the window light, of bent safety glass, retracts and forms the top portion of the fuselage. Air for the pilot is forced into the cabin through a flexible aluminum duct having its intake in the leading edge of the wing. For flight at altitudes in excess of 20,000 ft. oxygen will be supplied to the cabin.

A complete installation of flight and engine instruments is included in the plane's equipment. This includes a Sperry gyro-pilot, a Sperry gyro-magnetic compass, a Pioneer aperiodic compass and a Breeze exhaust gas analyzer which indicates whether the mixture of fuel and air coming from the carburetor to the engine is too rich or too lean. Westinghouse two-way transmission-reception equipment is carried in the plane as well as an ultra high frequency transmitter and receiver which will be used during research and experimental work. Antennae for this equipment are built into the wing, while those for the conventional set are paid out of the rear of the fuselage, below the rudder. The receiving antenna is built into the vertical fin.

Specifications and performances of the Hawks *Time Flies* with the 1150 hp P&W Twin Wasp are as follows:

Wing span	31 feet
Length overall	22 feet
Height overall	8 feet 6 inches
Wing area	160 square feet
Maximum speed	375 miles per hour
Cruising speed	340 miles per hour
Landing speed (with flaps)	65-68 m.p.h.
Rate of climb	7000 feet per minute
Cruising range	1700 miles

Take off in Safety Land in Safety on runways of CONCRETE



Rhode Island State Airport runways are each 3,000 ft. long by 150 ft. wide. Pavement consists of five 30-ft. sections each of 8-6-8-in. cross section, divided into 10-ft. lanes. (Upper view.)

The first takeoff from the new Dayton Municipal Airport at Vandalia, Ohio. Project financed by WPA funds.

Concrete's safety reaches out miles from the airport to the incoming plane. For pilots can see light colored concrete runways night or day. And when the plane settles down it has a smooth track to land on with ample traction for tires—no excessive crown, no puddles of standing water, no ruts or bumps.

Concrete's cleanliness and safety improve ground facilities; help attract business to any airport. Concrete is serviced in good weather or bad, shortens takeoff runs, is free from loose particles to be picked up by the propeller stream, endangering passengers and planes.

And the cost? Surprisingly low. For concrete runways can be designed economically for given wheel loads and landing impacts with ample safety factors. Concrete stands up under heavy loads; supplements its moderate first cost with long life and extremely low maintenance charges.

For safety, for service and for ultimate economy, your city's new airport should be concrete. Let us help you plan it by sending free Information Sheets and the booklet, "*Concrete Makes a Modern Airport.*"

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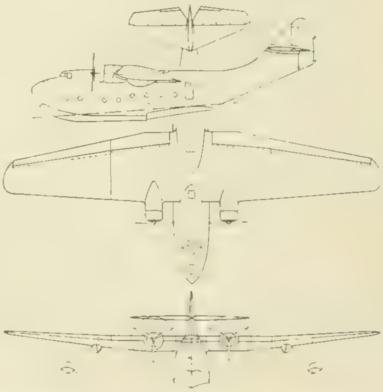
Douglas Twin-Engined Model DF Long-Range Flying Boat

Photo courtesy of Curtiss-Wright Technical Institute

● Latest development of the Douglas Aircraft Co. is the new 32-passenger all-metal twin-engined flying boat, model DF, designed for long range trans-oceanic service. This airplane carries 1620 gals. of fuel which gives it a non-stop full load cruising range of 1500 miles, and a maximum cruising range of 3300 miles with a 12-passenger load. In addition to the 32 passengers, the flying boat provides accommodations for a crew of four—pilot, co-pilot, navigator and stewardess.

The hull, which measures 9 ft. 7 in. is of the two-step type, the rear portion curving upward, is round in section, and incorporates an integrally-built fin. Covering is of smooth sheet metal. Interior of the cabin is insulated against noise and outside temperatures and incorporates modern developments for passenger comfort and convenience. The cabin is divided into four compartments, each with accommodations for 8 passengers. Compartments of the hull are formed by the transverse bulkheads. Just aft of the bow of the boat is the pilots' compartment with two side-by-side seats and the navigator's seat behind; aft is the passenger compartment and next aft are two side-by-side lavatories. Toward the stern position is a cargo compartment, access to which is through a door in the hull.

Wing is of all-metal full cantilever construction incorporating a flat-span center section and two outer panels. It tapers in plan from 17 ft. 6 in. at the engine nacelles to 8 ft. 4 in. at the outer edge of the inset ailerons. Ailerons have a span of 25 ft. and taper in chord from approximately 35 in. to 17 in. A corrugated metal covering extends from the leading edge back to about two-thirds of the chord. The remainder of the trailing edge, including the hydraulically-operated flaps and the ailerons are fabric-covered. The 40-ft. center section carries the wing flaps and the engine nacelles which are set 9 ft. 4.5 in. from the center line on either side of the hull and 4° upward from the line of flight. Outer panels are each 27 ft. 6 in. in span and their upper surfaces have a dihedral of 2° 30′.



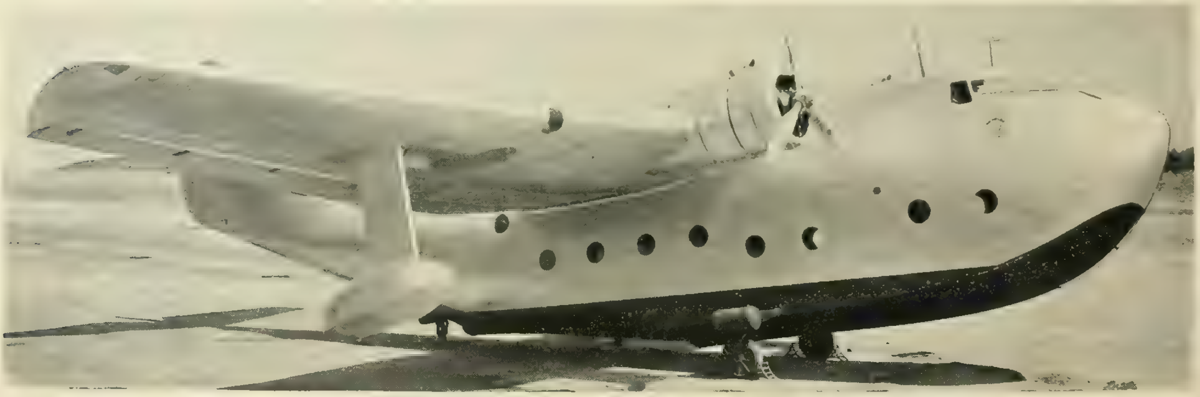
Cantilever construction also has been used in the all-metal tail unit which has a span of 30 ft. The fin is sheet metal covered, while the rudder and two-piece elevators are fabric covered. Elevators are statically and aerodynamically balanced and are equipped with trimming tabs.

One-step auxiliary floats are each connected with the wing by a single flat box-type strut. These floats are hydraulically retractable inward partially and recessed into the under side of the wing.

Power is supplied by two 1000 hp Series G Wright Cyclone engines (described in the September 1936 issue of Aero Digest) set into nacelles in the leading edge of the wing, and equipped with 3-bladed 11 ft. diameter Hamilton Standard constant speed propellers (also described in the September issue) which clear the water by 4 ft. 9 in.

Specifications and performance figures of the 1000 hp Cyclone-powered Douglas DF are as follows:

Wing span	95 feet
Length overall	70 feet
Empty weight	16,000 pounds
Useful load	12,500 pounds
Payload	2000 pounds
Gross weight	28,500 pounds
Maximum speed	185 miles per hour
Cruising speed	167 miles per hour
Maximum range	3300 miles
Normal range	1500 miles


Detailed view of the Wright-powered Douglas Model DF flying boat with retractable wing floats

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285hp Fleetwings “Sea Bird”

4-Passenger Amphibion

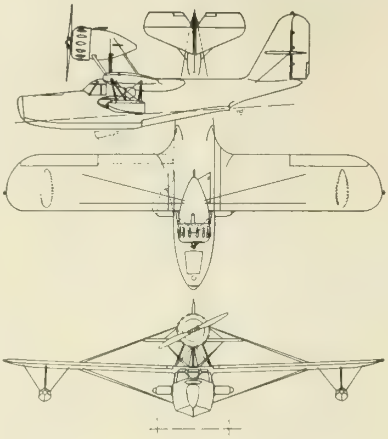
● Fleetwings, Inc., has completed and flown a new four-passenger amphibion which incorporates a number of new features, principally the use of stainless steel throughout which was fabricated by the shotweld process.

Use of this metal and process gives a fuselage and wing that are practically a one-piece unit. Streamlining has been enhanced also by the elimination of the protrusions or depressions usually caused by rivet heads, the shotweld process giving an exceptionally smooth skin, as well as strong welds. Further curtailment of drag has been obtained by keeping all fittings within the structure.

Known as the *Sea Bird*, the Fleetwings plane was designed by Carl de Ganahl and Wilson L. Dutton, president and vice-president respectively of the company. It is powered by a 285 hp Jacobs engine, mounted above the wing and, among other things, features a retractable tail wheel that can be used as a water rudder.

Construction of the hull follows monocoque practice. Stresses in the central portion, landing gear mechanism and nacelle mount, are carried by built-up steel tubes. Light former rings are tied together fore and aft with light stringers to which the skin is shotwelded.

Entrance to the cabin is through a hatch in the center section of the wing slightly aft of the nacelle, access being aided by recessed steps and retractable hand holds. Seats are arranged two abreast in tandem facing a full complement of flight and engine instruments and a throw-over type wheel control for dual operation. Instruments include a rate-of-flow meter (Eclipse) which indicates the rate of fuel consumption. Equipment also includes a direct electric starter.



Outlines of the Fleetwings amphibion

Soundproofing by Sperry has reduced the noise level below 80 db and quietness has also been enhanced by the clearance between the propeller tips and the hull. The exterior of the hull is finished in circular knurls. Space for 100 lbs. of baggage is provided in a large compartment back of the seats. The windshield is of a new non-breakable material which will not discolor nor become opaque and which has a transparency 7% greater than glass. The bow is provided with a corkboard bumper.

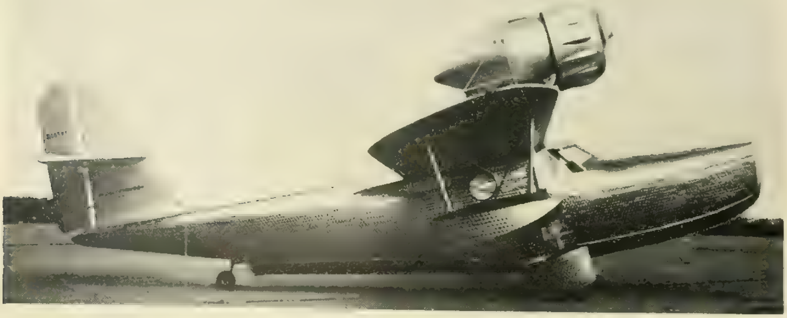
Wings are non-tapering, of stainless steel construction, and are covered by fabric. They are of the two-spar type with intermediate ribs and built-up drag struts and double diagonal tie rod bracings. Spars are box type with webs and caps corrugated longitudinally and provided with internal stiffeners. Ailerons and flaps are on ball bearing hinges, the latter being of the split-type hinged from brackets on the rear spar and operated hydraulically. Fuel is carried in two seam-welded stainless steel tanks located in the wings and having a total capacity for 52 gals. These tanks are shot welded and made principally of sheet metal with corrugations running parallel to the wing. End plates are made by drawing scalloped edges, also running parallel to the corrugations. The entire tank, while weighing 14.5 lbs. has a capacity for 26 gals. of fuel. Landing lights are retractable into the wings.

The retractable landing gear is also hydraulically operated from the cockpit by the pump that actuates the flaps. When the wheels are in the raised position, all struts disappear completely into recesses in the sides of the hull, the wheels remaining in a horizontal position and, being covered by metal fairings, act as small lifting surfaces. Flying wires and landing gear fittings are above the water line.

Although the *Sea Bird* is not the first stainless steel plane, it is the first built for other than experimental purposes and the first especially designed for this type of construction. In 1931, the Edward G. Budd Manufacturing Co., built the stainless steel *Pioneer* which flew more than 1000 hours. In 1934, Savoia Marchetti, Budd licensee in Italy, constructed a larger and more powerful version of the *Pioneer* to check it against the known performance of the same model in wood.

Specifications and performance of the 285 hp Jacobs-powered Fleetwings *Sea Bird* are as follows:

Wing span	40 feet 6 inches
Overall length	31 feet 5.5 inches
Overall height	12 feet 6 inches
Wing area	235 square feet
Wing loading	14.6 lbs./sq. ft.
Power loading	12.0 lbs./hp
Empty weight	2285 pounds
Useful load	1130 pounds
Gross weight	3415 pounds
Maximum speed	150 miles per hour
Cruising speed	135 miles per hour
Landing speed	47 miles per hour
Rate of climb	900 feet per minute
Service ceiling	15,000 feet
Cruising range	450 miles



The stainless steel hull is a feature of the new Fleetwings commercial amphibion

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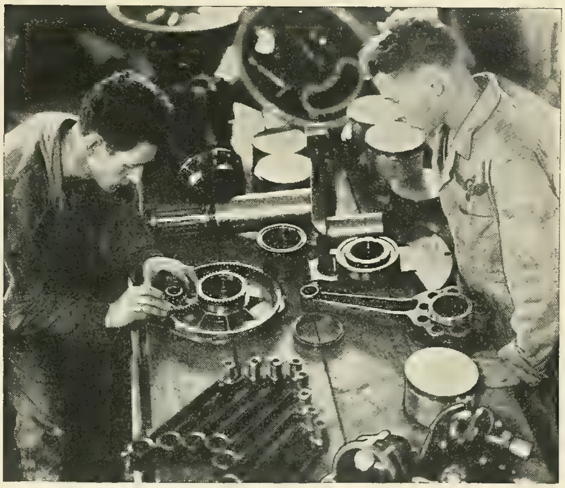
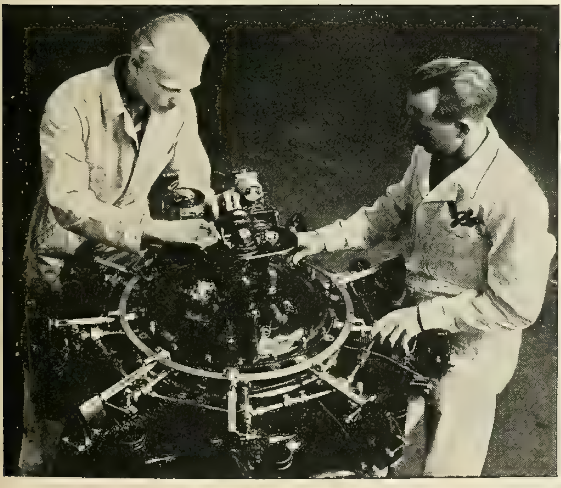
It is no accident that Lincoln Graduates fill many of these positions. The industry knows that Lincoln trains men *right*—that Lincoln's Mechanics School is one of the finest equipped schools in the country. Lincoln men are ready to go to work *the day they graduate.* Why? Because they've had practical experience—actual shop and ground experience with all the well-known airplane motors. They know wing and fusilage construction—aligning, assembling, inspection, sheet metal working, welding, woodworking and all the rest. That's what Aviation wants—men with practical experience. That's what makes the Lincoln Graduate so valuable to Aviation. That's why a Lincoln Man gets there quicker—goes ahead faster.

●

Lincoln is also Government Approved for all flight courses, including Transport. Eleven modern production training planes.





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EQUIPMENT and METHODS

General Purpose Airport Receiver

Designed especially for airport and airline ground station service, RCA Model AVR-11 airport receiver, covers all the frequencies in present use for aviation service, the standard entertainment band, and the high-frequency bands up to 23,000 kcs. This allows for possible future additions to the frequency ranges allocated to aviation services.

Incorporating the Magic Brain, Magic Eye, metal tubes, air trimmers and iron core i-f transformers, this receiver meets the requirements for consistent and satisfactory service in airport and airline operation and also provides for requirements that may possibly arise in the future.

Controls are conveniently mounted on the front panel and calibrated dial scales plus a 0-100 vernier scale permit accurate logging and resetting to the desired frequency. The tuning mechanism is equipped with a 100:1 ratio drive with a control knob for tuning and a crankhandle for rapidly transversing the scale. The band change switch is an engineered rotary switch with self-cleaning contacts that make a positive electrical connection to the individual coils.

Either loudspeaker or headphone operation is available and a calibrated beatnote oscillator provides for c-w reception. This beat-note is variable for ±3 kcs. A multi-purpose selector switch controls the unit on or off for both modulated and c-w signals and also permits a stand-by position.

Three models are available: a table model with all-metal cabinet and two models designed for rack mounting.

Rugged mechanical construction marks this equipment and assures satisfactory operation. Parts susceptible to rough handling normally encountered are fully protected. Thorough shielding of all circuits assures maximum performance and the radio-frequency portion is doubly shielded.

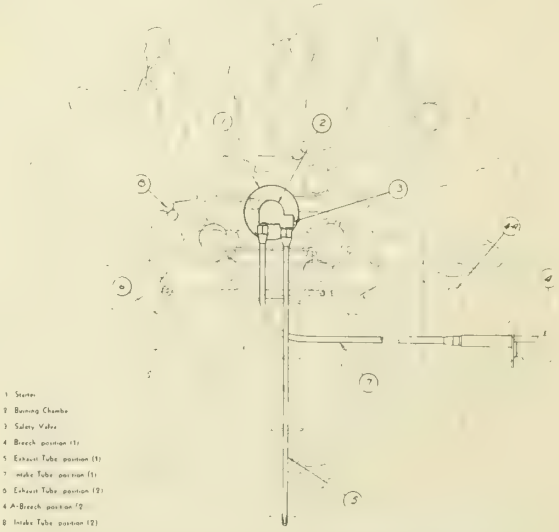
Cartridge-Type Engine Starter

Developed to fill the need for a light-weight and efficient method of starting engines in single or multi-engined aircraft, under all conditions, the Coffman engine starters, developed by Federal Laboratories, Inc., have already given satisfactory performances in field cold weather tests conducted by the U. S. Army Air Corps, the Naval Air Service and the Marine Corps. Featuring simplicity of operation and low maintenance costs, these starters have 8 slow speed movable parts, eliminate shock to the crankshaft and case at the starting and are self lubricating. Neither booster magnetos nor excess storage batteries are needed. Two models have been developed—Type M (which develops 1250 torque pounds) for engines less than 450 hp, and Type L (2150 torque pounds) for engines of 450 hp or more. Total weights are 25 lbs. and 35 lbs. respectively.

Source of power to operate the starter is derived from a cartridge. This cartridge contains a fuel which is ignited by passing an electrical current through the cartridge, which is placed into a breech usually located in the cockpit or near the pilot. Connected to the breech and extending to the starter, is a conduit which conveys the gas pressure generated by the fuel.

Any source of electrical energy can be used to ignite the cartridge, and one cell of a flashlight battery has sufficient energy to accomplish the action.

The starter is mounted on the standard 5" bolt ring engine mounting flange. To start the engine, an electrical contact switch, conveniently located in the cockpit, is pressed, thus effecting ignition of the cartridge. The fuel of the cartridge burns, develops pressure, moves a piston forward in the starter, engages the clutch jaw of the cranking shaft, and ultimately revolves the shaft.


1 Starter
2 Burning Chamber
3 Safety Valve
4 Breech position (1)
5 Exhaust Tube position (1)
7 Intake Tube position (1)
6 Exhaust Tube position (2)
4 A-Breech position (2
8 Intake Tube position (2)
①
②
③
④
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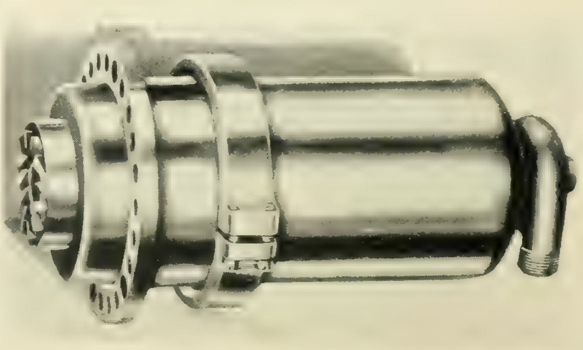
⑦
4-A

Coffman Engine Starter Mounted on Radial Engine Showing Two Plans of Installing Intake Tube and Exhaust Tube, and Breech



The Coffman cartridge-type engine starter

Heavy-Duty Fuse for Aircraft

A new line of aircraft fuses known as *Hi-Amp* has been developed for heavy duty service in the 110-volt 800-cycle line circuits of transport planes, United Air Lines accomplishing the experimental work in conjunction with Littelfuse Laboratories.

Eight hundred cycle alternating current was selected for the line supply because of the ease of transforming the electrical energy to the landing lights, radio equipment and interior lights. Current in these lines runs as high as 100 amperes.

Heavy brass end caps $\frac{9}{32}$" sq. with right angle lugs are used for mounting directly to the buss bar. Both lugs and caps are welded together and cadmium plated. The body is glass to facilitate inspection in service; overall length is 1.5" and unit weight 1 oz. Distance between lug centers is 1" for mounting inside standard fuse boxes. Anti-vibration features are incorporated to prevent blowouts in normal service, the standard overload being 10% and the blowing point 150% of the fuse rating. Standard ratings now in commercial use are from 40 to 100 amp. and in aircraft service are adapted for any power circuits up to 110 volts.

Engine Testing Instrument

An engine testing instrument which indicates engine efficiency by analyzing the exhaust gases as they emit from the end of the exhaust pipe, has been developed by the Hays Corp. Known as the *Orsatomat,* the instrument requires no electrical connections, and is simple and automatic in operation. It is self-contained and has been designed to stand the rough usage at the service shop. Except for a simple bearing to tilt the analyzing body to the sampling position and then to the reading position, there is no moving mechanical part and no friction except liquid friction.

In use, the operator starts the engine, inserts the sampling tube in the end of the exhaust stack, moves a rod to the sampling position, then to the analyzing position and reads the results of the analysis on a scale. The accuracy of the exhaust gas analyzer is due to the use of the scientific principle that the percentage of carbon dioxide in the exhaust gases is a reliable indication of the completeness of combustion.

A sample of exhaust gas can be analyzed in 20 sec. by simply operating a lever, the results being automatically indicated by a pointer on a scale.

Hydraulic Remote Control Units

A hydraulic remote control unit of unusual interest is being marketed by the Exactor Control Co., Ltd., of England, which is now negotiating for the sale of a manufacturing license in this country. This control system is used extensively both by Imperial Airways and the Royal Air Force, as well as by private pilots for engine control, control of trim tabs, flaps and retractable landing lights, and in other aircraft installations.

The apparatus consists of two elements—one, called the transmitter, being fitted with a hand operated lever and the other, or receiver element, having a lever which accurately follows the first without any loss of motion. The only connection is a single copper pipe.

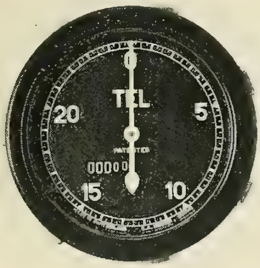
The transmitters, one for each engine, are mounted in the cockpit and the receivers are fixed on or near the engines. A ball-ended lever is mounted on the shaft of the transmitter and the corresponding shaft of the receiver is connected by a crank arm and link to the throttle valve. Cylinders of the transmitter and receiver are each fitted with a trunk type piston. Cylinders and connecting pipe are completely filled with a non-freezing liquid, and since both cylinders are of equal diameter, a downward movement of one piston gives a similar upward movement of the other.

The pistons are connected by rod and radial crank arm to their respective shafts, so that their longitudinal movement is converted into a rotary movement of the shafts. Fluid in the system is kept under pressure at all times by opposing springs acting on the two pistons.

The principle involved in the system is that of the transmission of movement by a column of oil, under pressure, by opposing springs situated in a transmitter and receiver. The operating lever imparts a movement to the transmitter piston, which is reproduced exactly by the receiver piston; this in turn operates the controlled medium accurately, without backlash or lost motion. The spring in the receiver end also assists the control on the return or suction stroke and assures, in the event of a pipeline failure, the lever being forced to the end of its stroke giving full throttle to the engine.

The control is synchronized daily before flight and at any time when there may be a variation due to temperature changes. Synchronization immediately and automatically resets the control. The synchronizing position on the throttle control is *full throttle* and on mixture control *extra rich mixture*. The control being filled with and operating in oil, no maintenance beyond periodical inspection of the level in the reservoir is required.

Since it is only necessary to mount the transmitter in the pilot's cockpit, connect the receiver to the engine and run the tube between the two units, this control system not only simplifies construction but also minimizes design problems and costs.

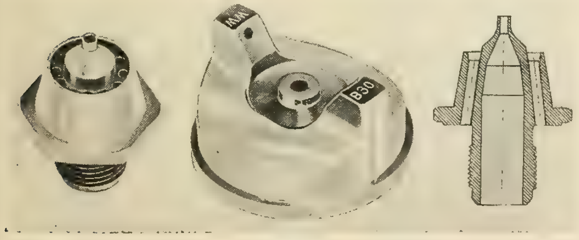


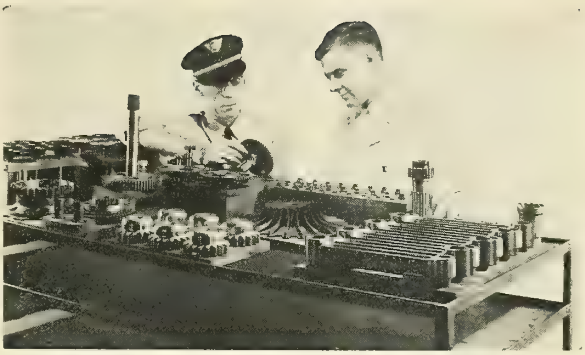
Tachometer and Engine-Time Recorder

An interesting instrument which serves dual purposes of indicating engine rpm and engine time, is being marketed by R. W. Cramer & Co. Known as the *Tel*, the instrument is produced by Hasler, Ltd., of Berne, Switzerland.

This chronometric-type tachometer has a non-resettable register which automatically totals engine time. The counter reads up to 999 hrs. 59 min. and at 1000 hrs. again starts from zero, thus giving ample margin of indication for top and major overhaul periods.

Views of new Milburn nozzle and atomizer heads





Various engine parts are put in separate wood racks to facilitate inspection and transportation

Racks for Engine Parts

As an additional precaution in handling aircraft engine parts, wooden racks made in designs for carrying these parts separately and preventing their nicking or scratching, are being used at the headquarters base of Transcontinental & Western Air, Inc., at Kansas City.

Individual racks for each classification of the steel engine parts are placed on the top of a movable steel tray which makes the rounds of the inspection, overhaul and assembly departments. Added efficiency in these departments is brought out in the use of these racks because of a mechanic's ability to tell instantly whether all parts specified are accounted for. Also, the rack containing any group of like parts can be lifted and placed on the bench for a mechanic's attention.

These racks are designed to hold the parts for which they are intended in a systematic order and eliminate any possibility of such parts from touching until after they have been inspected and serviced and are being assembled.

Improved Nozzle and Atomizer Heads

Improvements have been developed in the atomizer heads and fluid nozzles of the latest paint spray guns manufactured by the Paint Spray Equipment Division of the Alexander Milburn Co.

The fluid nozzle is made of wear-resisting steel with unusually long tapered seat, machined and burnished for alignment with atomizer head. Large, closely spaced air passages provide annular air supply to the atomizer head, resulting in a perfectly atomized spray. The internal tapered seat is finished to exacting specifications allowing the paint needle point to seat accurately and prevent dripping or spattering. The nozzle seats on the base of the thread of the head which keeps paint or other material entirely out of the threads, thus eliminating clogging.

The bronze atomizer head is of simple, one piece design, precision made with straight air passages eliminating friction and rendering it easy to clean. Ample air requirements are provided by large non-frictional air passages and expansion chambers.

Lightweight Instruments

A new line of pocket-size voltmeters, ammeters, and milliameters, designated Type AS-5 and superseding the Type AS-3, has been announced by General Electric Co. These instruments incorporate a new type of element with higher torque and improved characteristics, and have an overall dimension (the standard unit) of 5.5"×3.5"×2" and weigh 12 oz. All have an accuracy of 1% of full scale value.

The instruments have magnetic damping, a Permaloy moving vane, and are shielded from stray magnetic fields. All have a knife-edge pointer and a mirror scale for accurate reading.

Grip-Lock Bearings

Grip-lock bearings, latest addition to the SKF line of anti-friction bearings, offer the advantage of quick, simple application of the bearing without tools and insure positive locked bearings to the shaft.

Essentially, the bearing is the conventional SKF self-aligning extended inner race unit with an eccentric groove machined in its bore. Fitted in the groove is a piece of spring steel known as the grip-lock shoe. When the shoe is in the deepest part of the eccentric groove, the bearing may be readily slipped on the shaft. By holding the inner race of the bearing while the shaft turns in the direction of operation, the knurling at the ends of the grip-lock shoe grips the shaft. This causes the shoe to wedge in the shallow part of the eccentric groove and securely locks the bearing on the shaft.

Recent Aeronautical Patents

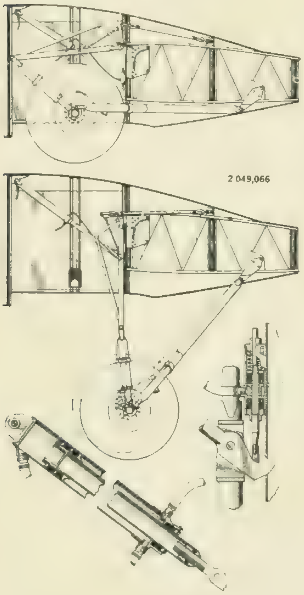
● The following recent patents of interest to readers of Aero Digest were compiled from the Official Gazette of the United States Patent Office.

Airplane landing means. Issac M. Laddon, Dayton and Sidney P. Lyon, Tippecanoe City, Ohio, assignors by direct and mesne assignments to Bendix Aviation Corp. (2,052,234)

Valve mechanism. Archie T. Colwell, Cleveland, Ohio, assignor to Thompson Products, Inc. (2,052,279)

Aircraft sign. John J. Grady, Hammond, Ind., assignor of 30% to Paul B. Eaton and 30% to Paul E. Piersol. (2,052,288)

Airplane having unique retractable landing device. James H. Kindelberger, Los Angeles, Calif. and Arthur E. Raymond, Santa Monica, Calif., assignors to Douglas Aircraft Co., Inc. (2,049,066)



Lighting control apparatus for airdromes. Gurdon H. Williams, Birmingham, Ala. (2,052,333)

Protecting metal surfaces from corrosion. Francis H. Snyder, Niagara Falls, N. Y., and Stanley F. M. Macclaren, Niagara Falls, Ont., Canada, assignors to Industrial Research, Ltd., (2,052,363)

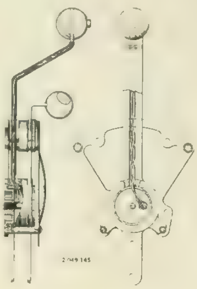
Indicator. Paul Kollsman, New York, N. Y. (2,052,409)

Rotary pump (for fuel, oil or vacuum pump for aircraft) Corydon M. Johnson, Freeport N. Y. (2,052,474)

Aircraft engine and gun assembly. Marc Birkigt, Bois-Colombes, France. (2,053,691)

Drift and ground speed meter. Philip V. H. Weems and Robert Henrick, San Diego, Calif. (2,049,096)

Control lever with switch. George E. Warren, Kenosha, Wisc. and George F. Haberstro, Jr., Buffalo, N. Y., assignors to Curtiss Aeroplane & Motor Co., Inc. (2,049,145)



Aircraft undercarriage. George Herbert Dowty, Cheltenham, England. (2,049,109)

Brake lever. Nels Erik Wahlberg, Kenosha, Wisc., assignor to Oaks Products Corp. (2,049,144)

Airplane. Heraclio Alfaro, Cambridge, Mass. (2,049,188)

Device for the safe landing of air vehicles. Theodore E. Level, Niagara Falls, N. Y. (2,049,209)

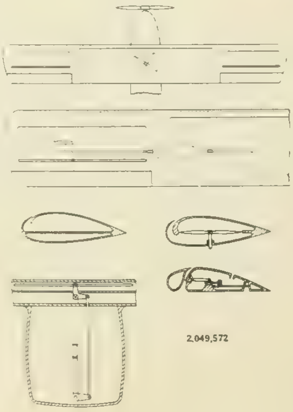
Tandem engine arrangement. Robert S. Van Atta, Rochester. N. Y. (2,049,339)

Rivet and method of setting the same. Louis C. Huck, Buchanan, Mich., assignor to Huxon Holding Corp. (reissue 20,055)

Method of making piston pins. Earl C. Abbe, Longmeadow, Mass. (2,049,411)

Aircraft. Christopher R. Wilson, Philadelphia, Pa., assignor of one-half to Harry Waldman. (2,049,482)

Aerodynamic control of aircraft, and control of aircraft. Edward A. Stalker, Ann Arbor, Mich. (2,049,572 and 2,049,573)



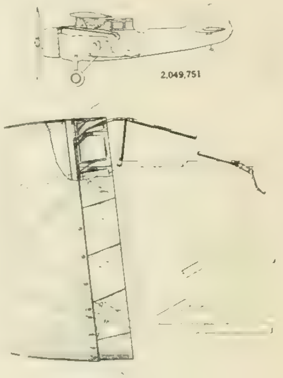
Method of dispelling fog. Henry G. Houghton, Jr., So. Dartmouth, Mass., assignor to Massachusetts Institute of Technology. (2,052,626)

Portable wire fence. John Kundert, Three Rivers, Mich. (2,052,774)

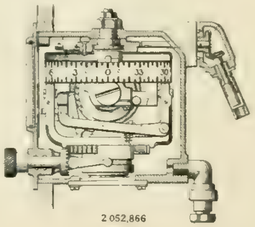
Shock absorber for aircraft. Fred Landgraf, Denver, Colo., assignor to Lewis-American Airways, Inc. (2,052,775)

Muffler (silencer for internal combustion engines). Eddy Latulippe, Montreal, P. Q. Quebec, assignor of one-half to Georges Kalfas. (2,052,834)

Engine cooling means. James M. Shoemaker, Hartford, Conn., assignor to United Aircraft Corp. (2,049,751)



Pilot directing gyroscope. Bert G. Carlson, Queens Village, N. Y., and Leslie F. Carter, Leonia, N. J., assignors to Sperry Gyroscope Co., Inc. (2,052,866)



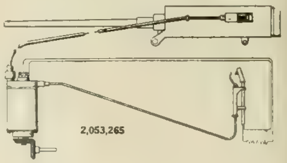
Bomb releasing device. Hans Raaber, Perkersdorf, Austria, assignor to Actiengesellschaft C. P. Goerz Optische Anstalt Actiova Spolecnost K. P. Goerz opticky ustav, Bratislava, Czechoslovakia. (2,052,845)

Spray gun. Robert W. Tracy, Toledo, Ohio, assignor to The DeVilbiss Co. (2,052,953)

Piston. Adolph L. Nelson, Detroit, Mich., assignor to Bohn Aluminum & Brass Corp. (2,052,985)

Aerial photograph calculator. James Warren Bagley, Fayettville, Tenn. (2,053,019)

Impulse generator (for machine gun). Richard C. Coupland, U. S. Army, Norfolk, Va. (2,053,265)



Cover fastening. S. T. Robinson, Hillsboro, Ill., assignor to Curtiss-Wright Airplane Co. (2,053,048)

Aircraft landing gear. Robert A. Swalm, Buffalo, N. Y., assignor to Curtiss Aeroplane & Motor Corp. (2,053,053)

Internal combustion engine. Lionel M. Woolson, deceased, by Emma F. Woolson, executrix, Bloomfield Village, Mich., assignor to Packard Motor Car Corp. (2,053,057)

Aileron control. Leonard O. Cederwall, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,053,064)

Engine mount. Charles E. Hathorn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,053,078)

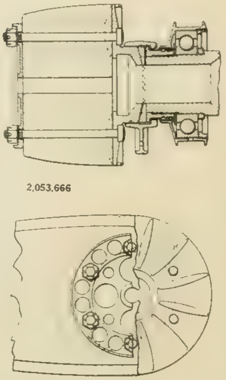
Amphibian landing gear. Guy A. Luburg, Snyder, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,053,093)

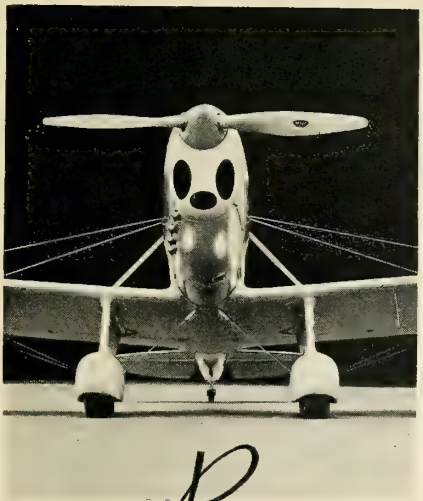
Bank and turn indicator and aerial flight integrator. Carl J. Crane and William C. Ocker, Brooks Field, Tex. (2,053,182 and 2,053,183)

Two-cycle engine. Benjamin Kahn, New York, N. Y. (2,053,242)

Fuel and like pump for internal combustion engines, and fuel injector for internal combustion prime-movers. George Amery, Kilburn, London, England. (2,053,311 and 2,053,312)

Propeller. Hellmut Hirth and Richard Weis, Stuttgart-Zuffenhausen, Germany. (2,053,666)





Beauty IS ONLY SKIN DEEP, IS IT?

IF YOU get a kick out of a well-proportioned airplane whose shiny surfaces glint like a mirror in the sun, you should see that plane being made —see the members which are hidden below the surface, the component parts woven into a precise, smoothly functioning unit.

Holding those members together, and aiding others to perform, are numerous obscure fittings. On them are imposed the strains of violent forces, the responsibility of human life.

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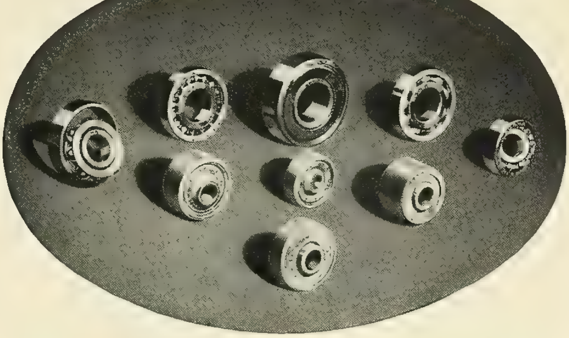

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Personairlities

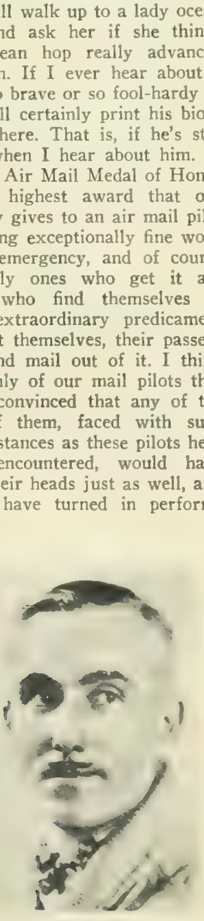
By Caldwell

● I've been trying to find some heroes to write about in these columns, but the nearest I can come to it are these notes about pilots who were awarded the Air Mail Medal of Honor by President Roosevelt, "for extraordinary achievement," which is the way the Post Office Department expresses it in the citation. Of course, if you were so ill-advised as to call any of these pilots "heroes" they would look at you sternly and remark, "When you call me that—smile!"

My idea of a hero is the fellow who will walk up to a lady ocean flier and ask her if she thinks her ocean hop really advanced aviation. If I ever hear about a chap so brave or so fool-hardy as that, I'll certainly print his biography here. That is, if he's still alive when I hear about him.

This Air Mail Medal of Honor is the highest award that our country gives to an air mail pilot for doing exceptionally fine work in an emergency, and of course the only ones who get it are those who find themselves in some extraordinary predicament and get themselves, their passengers and mail out of it. I think so highly of our mail pilots that I am convinced that any of the rest of them, faced with such circumstances as these pilots here have encountered, would have kept their heads just as well, and would have turned in performances just as admirable. And those who already have received the medal feel exactly that way about it, too.

Now, just to show you how I personally feel about our mail pilots and their fine work, I want to mention here a fact about myself that I never expected to put into print, because I've made it a rule never to write anything about myself unless it was in satirical vein—because I really do laugh at myself and my own foolish antics more than I do at the antics of you other monkeys who surround me. I've always been of the opinion that the chief difference between a man and a monkey was that the man had enough brains not to take himself seriously, and a monkey or a polar explorer hasn't.



Grove Tyler—as he was

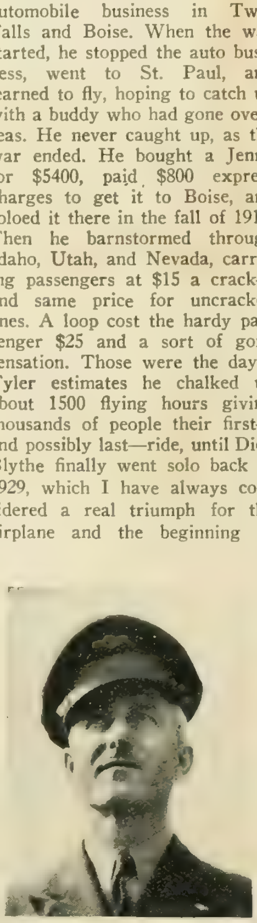
An Honorary Member

But one thing I do take seriously—and I hope I'm not just making a monkey of myself by admitting it—is that some years ago the Air Line Pilots Association made me an honorary member. That a group of men like the airline pilots should think enough of the old cynic to make him an honorary member touched me deeply and made me feel that perhaps the boys had detected a little worth and meaning in a life that I, myself, have found to be singularly meaningless. I have felt honored indeed to be accepted as one of them, and when my ashes are finally scattered over Roosevelt Field I want to have it mentioned that I was an honorary member of the Air Line Pilots Association—and once held the horse-shoe pitching championship of Pictou County, Nova Scotia.

Pilot Grover Tyler of United Air Lines was presented with the Air Mail Flyers Medal of Honor for an "extraordinary achievement" when he safely landed a plane with a slight case of fire. (It's always well to minimize the danger, just in case a passenger should read this.) It was on the night of March 2, 1931, that Fire and Fate got into collusion, as Jim Farley might say, and handed Tyler that medal. He was about 9 miles south of Glide, Ore., when he discovered smoke coming from the mail compartment—it turned out later that a letter from Bill Nye to a friend who was visiting in the East had burst into flames due to the spontaneous combustion of Bill's remarks on politics, or something. Of course Mr. Tyler knew nothing of this; all he knew was that the Boeing 40 was getting hotter than the makers ever had intended, so he looked with considerable interest at the country below, all of which was of the vertical variety, for in that part of Oregon if you miss your step you simply fall off the scenery and roll miles down hill. Remembering a clearing in the vicinity of Glide—an open patch about big enough to raise a box of cornflakes on—he headed for it and landed in a clump of small, pliant trees, which gently removed the wings in passing, thus breaking the full force of the impact.

Courteously assisted by the pilot, the passengers stepped out with great haste. One of them had a few cuts about the face and another burned his hands slightly—not by the fire but by picking up a hot fire extinguisher, of all things! Pilot and passengers then rushed to the mail compartment, dragged out the mail sacks, and threw the burning pouches into the swampy ground surrounding their landing place in the trees. Then they cooled off the fire extinguisher and put out the fire with it and some of the swamp water. A good time, on the whole, was had by all except Bill Nye's friend, who never did get that letter on politics, Bill's favorite subject. Tyler not only saved the mail; he saved his moustache, the only one of its kind in captivity. I hope it shows up in the picture, but if it doesn't, take my word for it that it's there, with points.

Tyler was born in Knox County, Nebraska, and attended the public schools in Boise, Idaho. He opened a plumbing and heating business in Twin Falls and Jerome, Idaho, but soon closed it right up again and tried the automobile business in Twin Falls and Boise. When the war started, he stopped the auto business, went to St. Paul, and learned to fly, hoping to catch up with a buddy who had gone overseas. He never caught up, as the war ended. He bought a Jenny for $5400, paid $800 express charges to get it to Boise, and soloed it there in the fall of 1918. Then he barnstormed through Idaho, Utah, and Nevada, carrying passengers at $15 a crack—and same price for uncracked ones. A loop cost the hardy passenger $25 and a sort of gone sensation. Those were the days! Tyler estimates he chalked up about 1500 flying hours giving thousands of people their first—and possibly last—ride, until Dick Blythe finally went solo back in 1929, which I have always considered a real triumph for the airplane and the beginning of



And—as he is today

Popular Flight. Dick got the plane up, and then the plane got Dick down, a fair division of labor. After word of this got about, practically everyone went in for flying.

In 1923 Tyler joined Vance Breese in the establishment of a flying school at San Francisco. Then in 1926, he helped Verne C. Gorst get Pacific Air Transport started. His first job was that of picking out intermediate fields and erecting light beacons between Los Angeles and San Francisco. With Arthur D. Starbuck, the other member of the original P. A. T. pilot staff, he drove up and down the San Joaquin Valley in a Ford, carrying picks and shovels and other tools. They personally installed the beacon lights over which they later flew the mail at night. But that's where Tyler made his mistake. If, instead of working, he had simply known a Congressman, he might have been made Assistant Director of Air Commerce, like Rex Martin, in charge of all the lights, and all the beacons as well. It isn't *what* you know; it's *who* you know, as Franklin said. I mean Benjamin Franklin, not Franklin Delano—though *he* could have said the same, for if he hadn't known Jim Farley he never would have got any further than ex-Governor of New York State.

On His Second Million

Well, crawling up again from the political gutter and getting back to Mr. Tyler, his career and his moustache, we leave him contentedly reeling off the miles on the Seattle-Oakland section of United Air Lines' Pacific Coast airway. That is, he's doing that when he isn't unravelling the knots in his 40 ft. cabin cruiser somewhere in Puget Sound. He has well over a million miles behind him, and is digging right in at his second million. His ambition is to stick to it until that moustache grows into a beard. It would take an Einstein to figure when that will happen.

* * *

● Also among these extraordinary gentlemen, who received the Air Mail Medal of Honor, is James H. Carmichael, Jr., of whom I have only a newspaper picture that probably won't reproduce, so I'll tell you that he stands 6 ft. 3, has brown hair, brown eyes, big ears, big teeth, and weighs 190 pounds. He writes me some facts about himself—I asked him for them or he wouldn't have sent them, in which he is unlike a young woman student who wrote in the other day stating that she had made her first solo successfully and intended to fly the Atlantic next summer, and would I please tell the world about her? (No, ma'am, I won't. There's enough suffering in the world as it is.) Carmichael apologizes for having such an uneventful career, and regrets that his biography cannot be as glamorous as some that have appeared here. I suppose he's referring to one I wrote about Roscoe Turner some years ago.

Engine Trouble

Carmichael is quite a young chap, born April 2, 1907, in Newark, N. J. The year 1935 proved to be his most exciting so far, so they gave him a medal for it. On the night of April 21 he left Washington in what started out as a tri-motored Ford but became a bi-motored Henry after 50 minutes of laborious air travel, and at an altitude of 3200 ft. This structural change occurred with no warning whatever. There was "an exceptionally loud crashing noise followed by several moments of rather severe vibration," to copy-cat the pilot's report to his company. Carmichael and his co-pilot, R. H. Taylor, aroused by this unseemly disturbance from their contemplation of the delights of air travel on Central Airlines, looked out of the windows. To the right they could see an engine, churning away contentedly; to their left no engine whatever obtruded itself between their eyes and the surrounding universe. It had taken no thought to the manner of its going; it had simply departed and now, presumably, again was a part of the darkened earth from which it had been wrought. Here indeed was a poetic fancy—from the earth it had come, to the earth it was returned, as the poet says—but the lads up front were not thinking of poetry at the moment. They were thinking how nice it would be to be back in Washington, even with Congress in session. Mr. Taylor went back into the cabin and—I quote the report—"informed the passengers that we were returning to Washington due to engine trouble." This, in my opinion, constitutes a world's record for tact in the matter of breaking it gently to the passengers that their plane has lost an engine.

In their interested survey, the tactful Taylor and Carmichael discovered that in addition to engine trouble they also had a trifle of landing-gear trouble, though just how much they couldn't precisely determine. They had less than a whole landing-gear; they knew that much at a glance. So they decided to fly to Bolling Field, where the mechanics have had so much experience with Army pilots that they know exactly what to do in the event of a crash on landing.

The passengers — there were six of them—were soothed by Mr. Taylor and showed no alarm. With all the nonchalance of guinea-pigs awaiting some new experiment, the patient passengers simply sat there calmly. And all was going well, so far. On two engines the noble Ford—heeding perhaps the motto of the Royal Flying Corps, which is Per Ardua Ad Astra (meaning By Labor to The Stars)—labored onward and even upward, climbing to 3400 ft. as it staggered back to Washington, the Port of Missing Men:—so called because many who have missed success in honest commercial labor try to get there and be fed by the tax-payers.

Bolling Field cooperated one hundred percent: they turned out just as they used to do when their own Army flyers were trying to land there by stalling in over the hill. The Ford glided down after flying on two engines and its reputation, rolled on the right wheel and the tail wheel at the command of Mr. Carmichael, until it lost flying speed. Then it gently dug its left landing-gear struts into the ground and slowly ground-looped in a dignified manner befitting one of its age and sedate habits of movement. The six guinea-pigs—pardon me! I mean passengers were hardly jolted in their cages—I mean, their seats. They stepped out, smiling and nibbling their lettuce sandwiches, quite undisturbed. In a moment, they were whisked over to Washington-Hoover Airport, from which they had started originally, and soon were being wafted aloft again in another and complete Ford, to try the experiment all over, this time successfully, right to Pittsburgh. Science marches on!

Another Experience

Carmichael had another interesting night in 1935, his best year. It was the night of Nov. 15, and he and his airplane, a nameless tri-motor, had started off from Pittsburgh, with a great burst of enthusiasm which carried them to a height of about 50 ft. above the ground and at a speed of 100 mph. The landing lights were off and the landing gear retracted, when the enthusiasm of the center engine suddenly cooled. It started to rev down. Not knowing exactly what had happened, the quick-thinking Mr. Carmichael opened the outboard engines with the intention of circling the field and coming in for a landing—a good thought, as thoughts go. At the same time he proceeded to use the wobble pump, so called because when the engine gets wobbly, you wobble it to give the carburetor a shot in the arm. At just about that time the outboard engines started to quit. "Realizing," says the pilot in his official report, "that there was no hope of restoring the engines to normal conditions, I proceeded to make an emergency landing and get out of things as well as I could. This landing was made straight ahead and I got the ship down on the unpaved and unfinished east end of the runway."

You will note here that Mr. Carmichael is not an optimist; he is a realist—which is why he is still with us. When an engine, or three engines, pack up, Mr. Carmichael does not delude himself with the hope that they will miraculously come to life again and drag him around a 180° or even 360° turn, as so many pilots have hoped—in vain, as it invariably turned out. Like Farragut, he simply said, "Damn the engines—go ahead!" And straight ahead, without turning, he went. It's the only way to go from a low height without engines—straight ahead. I stress the point, for the good of aviation, not for my own good—for I own five shares of National Casket. The ship landed, slid along, and ran over the edge of a hill, landing nose first at the bottom with resultant damage to the airplane but none to the passengers or crew.

James Carmichael moved around a lot as a youth—his family kept on moving, which is cheaper than paying rent they say. He attended Suffield Military Academy and the University of Nevada and tried to become a farmer in Riverside, Cal. and then in Bangor, Mich. But farmers weren't on relief then, so he quit and went to Chicago in 1927 where he decided that flying was the most gentlemanly way of being lazy, as you sat down to work at it. He studied the art under Gus Palmquist, Al Meyers and Elmer Kane, and started working at Chicago Municipal Airport hopping passengers. Then off and on he worked for Newark Air Service and others. In 1931 he had his first airline experience with Pittsburgh Airways, nine months of it, then back to Newark Air Service until April, 1934, when with the formation of Central Airlines he became the first pilot hired by them. He's married—all the good ones are married—has the nicest of wives, he says, and the nicest of all baby girls. Chief hobby is keeping them happy—and a mighty good hobby, too.

CYDELITES ON THE NEWS

●

CY CALDWELL

● Lieut. Charles B. Dougher, U. S. Army, was flying a new Martin bomber on a routine night-flying mission over Mitchel Field last August. His passengers were two steel-nerved defenders of their country, Privates Michael F. Cycon of the 99th Squadron and Edward Kayser of the station complement. With their headphones they were listening to the pilot asking the Mitchel Field radio station for landing instructions, when the plane flew into a bank of clouds. Evidently imagining that disaster impended—it was apparently their first cloud—the two valorous airmen bailed out, making a safe landing near Roosevelt Field. They walked back to Mitchel, startling the pilot by greeting him when he landed an hour later—they had been in the back, and he didn't even know they'd left him.

As the waiter at the quick lunch shack on old Curtiss Field, now Roosevelt, used to bawl years ago to the cook when someone ordered poached eggs, "Drop two—sunny side up."

● Miss Berdina Doup, of Danville, Ohio, fell while roller skating, infection developed, and her left leg was amputated. Mr. Earl P. Laughlin, of Youngstown, Ohio, also lost his left leg in a motorcycle accident. Mr. Laughlin bought himself an artificial leg, liked it, became a salesman of artificial legs, and sold one to Miss Doup, who liked her artificial leg, also liked Mr. Laughlin, and married him. Now the happy couple may be found often at Seidner Airport in Youngstown, flying around in a new Taylor *Cub*. Be careful of those two remaining legs, folks.

● The March of Progress, as this helter-skelter pandemonium that we human mites kick up is called, does not always favor the airplane. Recently Progress has plowed under two airports near New York City—the east section of Roosevelt Field, and the whole of old Curtiss-Wright Valley Stream Airport. We may definitely set down the elimination of the latter as a Forward Step in Civilization, or something, for it never should have been an airport in the first place—and never was, do I hear someone murmur? Anyhow, it's going, and soon will be gone. The planes moved away long since, and the steam shovels and carpenters are moving in. The Chanin Organization, builders of skyscrapers, apartments, and theatres, has taken over Casey Jones' old marsh on which you could raise only dust in dry weather and bull-frogs in wet, and is starting to build a village of moderate priced homes. Pilots who have given up commercial flying and gone into other work may have enough money to buy one. The village is to be called "Green Acres," apparently in memory of the stockholders who developed the property as an airport. Streams forming natural boundaries on two sides of the large plot will be diverted into a ten-acre lake, instead of wandering over the runways, as they used to do. In the lake, which will be surrounded by shrubbery and probably empty beer bottles, and bits of discarded sandwiches, will be swans, ducks, and fish. And maybe—who knows?—on warm sunny days such old pilots as Casey Jones and Frank Ambrose may be found swimming along among the reeds, reminding themselves of the old days when they harbored the delusion that it was an airport.

Whether the elimination of part of Roosevelt Field is in the interests of Progress is matter for speculation. They've turned the part where Lindbergh, Chamberlin, and Roger Williams took off—and where Charlie Levine and Rear Admiral Byrd were taken off—into a Raceway for automobiles. It isn't an oval track like that at Indianapolis where the cars usually crash outwards, but an affair of one straightaway and a maze of about sixteen turns, from which the interesting racing buggies may be expected, and in fact are hopefully expected, to shoot off in all directions, like Roman candles. The real idea back of automobile racing is not to discover which car and which driver are the fastest, but to find out which ones go off the track in the most interesting, entertaining, and blood-chilling manner. It's the old idea of the Roman Coliseum with modern machineage attachments. Of course, under the sentimental hypocrisy which is the rule in these degenerate times, it is customary to declare that these races are run in the interests of science to see what improvements can be made in motors, tires, brakes, carburetors, and so forth. The fact remains, though, that if nobody ever got killed in a rapid and startling fashion, the non-engineering-minded public wouldn't pay anything to watch a mere laboratory process—and the same goes for air races, naturally. And that is not to condemn either; it's just to admit that as human beings we still are willing to pay our money to see blood and slaughter. A promoter can drum up a million-dollar gate for a championship prize fight, but he couldn't collect two dozen non-medical humans to pay twenty bucks apiece to watch two scientists discover a cure for cancer.

● Aviation is advancing by leaps and bounds in the up and coming city of Great Falls, Montana, as disclosed in a news release from Thompson Bros. Balloon & Parachute Co. of Aurora, Ill., who put on a show at the North Montana State Fair in that interesting city: "Another outstanding thriller on the program was Captain Frakes who crashed squarely into a house in the center field (built especially for the stunt). The plane was reduced to a tangled mass of twisted tubing and shredded wing surfaces from which spectators extricated the flier, shaken and bruised but otherwise unhurt." This sounds like Dick Blythe flying under an assumed name.

● How the More Abundant Life has missed the long-suffering Reserve Officers is sadly mentioned in a Memorandum from Headquarters Third Corps Area, United States Army, to all Reserve Officers: "With reference to the Army Regulations 140-5, dated June 16, 1936, this headquarters has been informed by the War Department that funds are insufficient to permit a general distribution of this publication (Announcement of Army Extension Courses 1936-1937) to all Reserve Officers. However, copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at ten cents each." Brother, can you spare a dime?

● Ian M. Fraser, a 24-year-old Scotch aircraft mechanic with Imperial Airways at their No. 2 Depot, Cairo, Egypt, writes that he is particularly interested in radial engines, upon which he works, and would like to correspond on technical problems with American mechanics doing similar work with American airlines.

He'll answer letters sent and supply his own stamps—a concession on the part of a Scotchman. Now just because I put this in here, in the interests of the exchange of aviation knowledge, don't think that I'm going to supply telephone numbers to lonely mechanics around the globe. If I had a good number I'd call it myself.

● Talking about speed—though nobody was even thinking about it till I brought it up—a man made a speed record of 140 mph away back in 1908. No, it wasn't in an airplane, an automobile, or a railroad locomotive. It was in an iceboat. In the winter of 1908 Elisha Price, who died recently at the age of 83, sailed the *Clarel*, an iceboat carrying 200 sq. ft. of canvas, over a 15-mile course near Long Branch, N. J., and his official recorded top speed was 140. For the entire 15 mile circuit he averaged 105 mph, including turns. In 1908 his record of 140 was the world's speed record for any sort of conveyance; and it was not until 7 years later, in 1915, that it was surpassed by Ralph DePalma who drove an automobile at Ormond Beach, Fla.

● Despite the depression, which they tell me is now over—or is it?—American airlines have doubled their passenger traffic in the past two years. They carried slightly over 460,000 passengers in 1934, 747,000 in 1935, and are expected to pass 900,000 this year. It must have been the stimulating effect of that one publicity flight that Dr. Roosevelt took. Say, how about starting a movement to get him up again?

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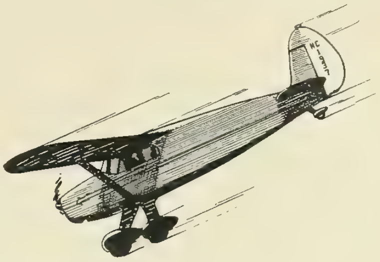

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DIGEST OF THE NEWS

AIRPORTS

Cotton Runway

What may be an important development in airport runway construction will be demonstrated Dec. 16 at Riley Field, Fort McClelland, near Anniston, Ala., when the cotton fabric runway is opened.

This runway has been under construction for several months. The fabric is applied to the base as a means of holding it together and preventing breakage and buckling of the paving. The finishing coat of paving materials is applied on the top of this base.

Successful Season

Winnipesaukee Air Service, Inc., The Weirs, N. H., have just completed their 14th season, during which time they flew more than 50,000 passengers in their seaplanes. During the past summer they logged 500 hours, made 2000 flights and carried 5000 passengers.

Equipment consisted of a Beechcraft, Stinson and a Waco, all equipped with Edo floats. Personnel included Thomas E. P. Rice, pres., Capt. Bob Fogg, operations manager, and pilots Andrew Cannon, Mike Harlow and Jack MacManus.

Airport Leased

Russell Holderman, who designed the Donald Woodward airport in LeRoy, N. Y., and has been connected with it since its opening in October, 1928, has leased the hangar, show and flying field to J. A. McPeke and George Maglemre who have taken possession. The new proprietors will continue to operate the airport, doing commercial flying, dealing in planes and conducting a repair shop. Holderman is now chief pilot for the Gannett Newspapers, operating from Rochester.

New Airports

The new $1,000,000 airport at Nashville, Tenn., was dedicated Nov. 1.

* * *

Purchase of 640 acres near Mukilteo for a new airport was made by Snohomish County commissioners on a site 21 miles north of Seattle and seven miles south of Everett, in one of the most fog-free areas of Puget Sound. The airport will have four runways, each 5200 ft. long.

Improvements

Cincinnati, Ohio, Lunken Airport. Work resumed on administration building. $145,900. WPA and city project.

Iowa City, Iowa, municipal airport. Extension of runways.

Memphis, Tenn., municipal airport. Gravel and asphalt runways; leveling of field. $225,000. WPA project.

Poplar Bluff, Mo., municipal airport. Eight-plane stone hangar. $19,905. WPA project.

St. Louis, Mo., Lambert Field. Extension of two runways by 1500 ft.; construction of bridge on roadway to field; 2800 ft. roadway; landscaping.

PRIVATE FLYING

Miami Races

Sixty-one committees are now completing preparations for Miami's Ninth Annual All American Air Maneuvers scheduled for December 10, 11 and 12, while workmen are renovating the Miami Municipal Airport to insure suitable take off and landing facilities for racing planes and military aircraft. Approximately two and one half miles of paved runways are now under construction. An additional 3600 grandstand seats together with a new steel and concrete control tower for timers, press representatives and officials of the meet, are included in the building program.

Officials in charge of the air maneuvers state that Marine Corps participation will include three squadrons from Quantico. Tentative plans of the Navy for participation call for a flight from the Pensacola Air Station, as well as the Navy stunt team.

Plans of the U. S. Army Air Corps have not yet been announced, but GHQ has already made preliminary arrangements to be represented.

An innovation will be the Aircraft Exhibit as well as the Cub Convoy. The Convoy will leave Atlanta December 8, stopping at Cordele, Lake City, Orlando and either Vero Beach or Ft. Pierce. Entrants need not join the Convoy in Atlanta; they can join at the most logical point nearest their base while the Convoy is en route. At least 25 Cubs are expected by the time Miami is reached. Officials of the Taylor Aircraft Co. have offered to pay hotel expenses of the pilot of each Cub for four nights.

The Air Race Contest Committee of the air maneuvers have agreed to have a race for "C" licensed planes, allowing no ships over 40 hp to compete. Pure Oil Co. have donated a silver trophy and $100 in a competitive event in which only Cubs will be allowed to participate.

Those interested in joining the Convoy can communicate with Blevins Aircraft Corp., Atlanta, Ga.

The Contest Committee, in charge of the racing events open to civilian pilots announce a total of $6,000 in prize money that has already been set aside, guaranteed by the City of Miami, and efforts are being made by the committee to secure an additional prize fund.

Events

Stunt pilots from the National Air Races performed October 4 at Sky Harbor, near Chicago, the proceeds going to charity. The program consisted of races, sky writing, and balloon bursting contests.

Harold Johnson stunted a Ford tri-motor; Milo Burcham did inverted aerobatics in his Boeing and Capt. Dick Graenere demonstrated his "crazy flying" in a Curtiss Junior.

* * *

The first Aerial Treasure Hunt in Georgia completed a successful three-day tour at Candler Field, Atlanta, with forty planes competing in the tour. Fourteen Georgia cities were visited and it is now planned to make the hunt an annual feature.

* * *

A crowd of 50,000 witnessed the final air show of the season by the Linco Flying Aces at Findlay (Ohio) Airport. Performers included Lieut. Joe Mackey, Mike Murphy, Gordon Mougey, Jr., Bill Sweet, Ed Leach, Don Walters. Major Fred L. Smith, state director of Aeronautics led a squadron of Ohio National Guard planes in a program of military formations.

* * *

Summary of results of the Detroit Air Races shows Don Rae the winner of the four racing events. Flying the Menasco-powered Folkerts Special which was first flown at the National Air Races, Rae averaged 208.8 mph during the 375 cu. in. free-for-all event for his best performance. Art Chester flew his Chester Special to second place in the three events he entered. Other speed contestants were S. J. Wittman, Ken Barber and Ed Smith.

AIRLINES

Special Freight Service

Freight service utilizing Ford tri-motors, specially-equipped, has been started by Transcontinental & Western Air. These Fords have a payload capacity of 3500 lbs. and will be used, at first, on the TWA line between New York and Chicago with intermediate stops at Philadelphia, Pittsburgh, Columbus and Indianapolis. Service probably will be extended from Chicago to the West Coast in the near future.

Midnight to dawn service is offered in each direction with departures from New York and Chicago late at night and arrival at the other terminal before the opening of business.

Assignment of this equipment to the transportation of freight does not conflict with operation of TWA regular air express service. The latter, operated under the name of General Air Express will be continued. This service, commands a higher rate than the air freight, as express consignments are carried from coast-to-coast on the regular TWA planes.

Rates for the new freight service have been reduced as much as 57% from the regular

(*Continued on following page*)

Loading express on a TWA Ford converted for freight use

Announcing the

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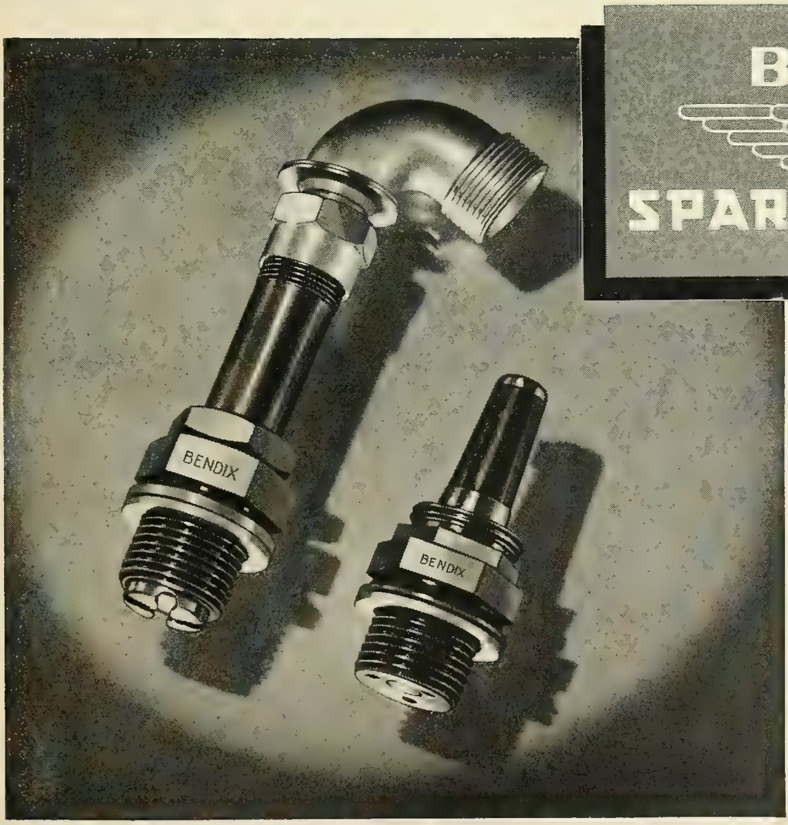

BENDIX H-T SPARK PLUGS

FOR AIRCRAFT ENGINES

SCINTILLA MAGNETO CO., INC.
(Subsidiary of Bendix Aviation Corporation)
SIDNEY, N. Y.

(Continued from preceding page)

tariffs charged for air express. Between New York or Philadelphia and Chicago for instance, the charge is $12 per hundred pounds as against the regular air express rate of $28 per hundred.

Re-equipment

Delta Air Lines has revamped its short wave radio communication system involving the installation of $20,000 worth of new equipment. The new 400-watt stations now installed make direct communication possible. In addition a new Lockheed *Electra* has been purchased.

* * *

New, all-metal Lockheed *Electra* transports are replacing the present ships on the lines of Boston-Maine—Central Vermont Airways.

Use of the new ships will reduce flying time over Northern New England so that the schedule on the New Hampshire-Vermont line from Boston to Manchester, N. H., will be 16 min.; to Concord, N. H., 28 min.; to White River Junction, Vt., 52 min.; to Barre-Montpelier, Vt., 72 min. and to Burlington, Vt., 91 min.

106,143 Passengers

The 22 scheduled airlines operating in continental United States carried 106,143 passengers in August 1936. These lines flew 6,046,421 miles, carried 565,358 pounds of express, and flew 43,109,200 passenger miles during the month. Compared with August 1935, figures for this year were better for passengers, express and the percentage of seats used, the comparisons being, respectively 106,143 and 89,581; 565,358 lbs. and 392,212 lbs.; and 67.47% and 59.13%.

* * *

United Air Lines carried 163,000 revenue passengers during the first eight months of 1936 to establish a 17% traffic increase over its total of 140,150 passengers transported during the comparable period of last year. At its present rate, United will exceed the 200,000 revenue passenger mark for the year. In view of its sustained autumn passenger loads, the company plans no schedule reductions.

* * *

National Parks Airways carried 64% more passengers during September 1936 than during September 1935, and passenger revenue was 68% better over September of a year ago.

* * *

Passenger, mail and express traffic over Transcontinental & Western Air, Inc., in August exceeded any comparable period in the company's history. Increases ran as high as 38.4% in the case of air mail flown in the recent month compared with August, 1935.

Amounting to 249,195,888 air mail pound miles, August's total exceeded the like month of a year earlier by 69,165,954 pound miles, representing the heaviest mail loads ever carried by TWA for the month. Other all-time highs included revenue passenger miles which, at 7,300,955 in August, exceeded the 6,802,888 miles for a year earlier by 498,067 miles or 7.3%, and, air express pound miles, as reported by TWA's independent system, General Air Express, standing at 41,551,585 pound miles, an increase of 31.3% or 9,905,210 pound miles compared with 31,646,375 pound miles reported for the like month of 1935.

The level of traffic experienced brought the cumulative total to August 31 far beyond any comparable eight months in the ten years of the company's or predecessor companies' history. Increases of 13.1% for revenue passenger miles, 37.8% for mail pound miles and 36.3% for express pound miles were revealed in a comparison with the first eight months of 1935.

* * *

Chicago and Southern Air Lines carried more passengers, mail and express during the first nine months of this year than during any previous nine-month period in the history of the company, according to Carleton Putnam, president. 6510 passengers, 135,358 lbs. of mail and 36,002 lbs. of express were the totals.

* * *

Airline passenger traffic in and out of Lambert-St. Louis Airport in the first seven months of 1936 totaled 12,735 an increase of 3842 over the corresponding period of last year. The three airline companies using Lambert Field facilities report a total of 1124 passengers in and 1219 out in July of this year.

* * *

Transport operations at San Francisco Airport for the month of August disclose the total schedules in and out of the field were 2042, an increase of 36% over August, 1935. 7395 passengers were carried, an increase of 36%; mail poundage out totaled 48,186, an increase of 30%, while 51,139 lbs. were received.

More Pilots

Twenty new pilots have been added to the roster of Transcontinental & Western Air's flight personnel while seven additional hostesses and twelve mechanics have also been engaged.

With the commissioning of the twenty new Captains and First Officers TWA's flying staff numbers more than 125 pilots.

Fare Reductions

New low fares went into effect November 1 as special winter rates, over the Transcontinental & Western Air route, thus bringing minimum cost of plane travel on the system to an approximate cost of ordinary train service and under extra-fare train rates.

Reductions apply to all stops on the system. Minimum New York to Chicago fare, using air scrip, is reduced to $33.96, or 71 cents more than the regular train fare of rail plus Pullman. On the transcontinental trip between New York and Los Angeles, or San Francisco, minimum fare is $118.96.

Regularity

Flying 1,326,824 miles out of 1,348,302 scheduled, American Airlines in July maintained an operating efficiency record of 98.4% over its more than 6800 miles of airways. Perfect adherence to schedules was accomplished on the Chicago-Ft. Worth, Cleveland-Nashville, and New York-Los Angeles routes, as well as on the Chicago-New York route.

* * *

United Air Lines completed 100% of its scheduled flights during July, flying all of the 1,571,522 miles scheduled. The record was made on the transcontinental and Pacific coast systems, and taken with the reliability figures for May and June brought its performance to 99.9% of flights scheduled.

* * *

A perfect operating record for August over its coast-to-coast route in point of completion of all its passenger and express schedules upon which air mail also was transported, was reported by Transcontinental & Western Air, Inc. The company flew 249,195,888 mail pound miles in compiling the record.

Personnel Changes

Appointment of Arthur W. Stephenson as vice-president of National Parks Airways, Inc., was announced by Alfred Frank, president. In his new capacity, Stephenson will continue as manager of operations for the airline.

Trans-Pacific Fares

Schedule of air fares for passenger accommodations on Pan American Airways service across the Pacific are as follows (rates are from San Francisco): to Honolulu, $360; Midway, $445; Wake, $587; Guam, $704; Manila, $799. Fares include ground transportation at all stations except San Francisco, meals aloft, berth San Francisco-Honolulu, and overnight hotel expenses at Midway, Wake and Guam.

Schedule Changes

Added to the list of cities served by the airlines with mail service were Santa Barbara, Calif. on AM-11, and Joplin, Mo., on AM-30.

* * *

Plans for extension of Braniff Airways, Inc., into Mexico City, via Monterrey, and construction of approximately 750 miles of airway are announced by president T. E. Braniff. Service is expected to be inaugurated this winter.

The line will extend south from San Antonio. Braniff now connects at Brownsville with Pan American Airways' route through Tampico and Mexico City into South America. This connection will be continued and the schedule of the new service arranged for a different time of day. Construction of intermediate landing fields, an airport at Monterrey, setting up field transportation system, a complete radio system and the establishment of weather bureaus will be necessary.

* * *

Revisions to its flight schedules offering a new early morning service from Washington and Pittsburgh to Cleveland and Detroit, and a second daily through service from Milwaukee and Michigan points to the Nation's Capital were announced by Pennsylvania Airlines.

* * *

Demand for Douglas Flagship sleeper service between New York and Los Angeles resulted in a second schedule between these cities by American Airlines, Inc. Schedule calls for an evening departure of *The Southerner* at 8:40 pm (EST) and arrival on the west coast at 11:42 am (PT), completing the journey in 18 hours 2 minutes. Four stops are made en route—at Memphis, Fort Worth, El Paso and Phoenix. Eastbound, the flight will be terminated in 16 hours 23 minutes.

AIR SERVICES

Reserve Bases

Naval Reserve Aviation units located at the Navy Yard, Philadelphia, the Naval Air Station, Anacostia, D. C., and the Naval Air Station, Norfolk, Va., have been designated as Reserve aviation bases, the change being made to place in effect the established policy of the Navy Department to standardize Naval reserve aviation bases.

These bases will be placed in the same status as the eleven other bases now established as regards command, administration and annual competition for relative standing. They will be pro-

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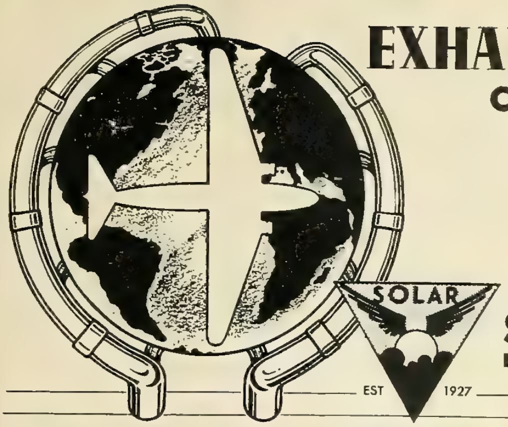

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TAYLOR AVIATION CORP.
ALLIANCE, OHIO

(Continued from preceding page)

vided with equipment to make them self-sustaining in the maintenance and overhaul of aircraft and engines, and to provide training in aviation repair work for enlisted men.

New Army Base

Ground has been broken for the construction of Sacramento's new $7,000,000 air repair depot. In the presence of approximately 15,000 spectators, and while four Army Air Corps squadrons soared over the site near Ben Ali, Frank F. Merriam, Governor of California, pushed down on a plunger which set off a blast of dynamite as the signal for the start of work. This site, when the project is completed, will house the Army's repair center for planes on the Pacific Coast, Hawaii and the Philippines.

Gyroplane on floats for the U. S. Navy

Float-Equipped Gyro

Initial flights of the Navy XOZ-1 Gyroplane on floats, were completed at Essington, Pa., under the direction of Burke Wilford, president and Elliot Daland, chief engineer of Pennsylvania Aircraft Syndicate.

Powered by a 155 hp Kinner K-5 engine, the plane has a gross weight of 2000 lbs. Diameter of the rotor is 32 ft., span of the fixed wing 28 ft., rotor disc area about 800 sq. ft., and fixed wing area about 100 sq. ft.

The manufacturers hope to develop this type into an aircraft which will have a minimum landing speed of less than 40 mph, and a maximum speed of between 150 and 200 mph, with reasonable horsepower loading.

Trophy Winner

Noel Davis trophy given annually to the most efficient aviation division of the Naval reserve in the United States, has been awarded for 1936 to the First Aviation Division Squadron VN-17 RD9, of Fairfax Airport, Kansas City.

Flight personnel of this squadron is composed entirely of pilots of Transcontinental & Western Air, Inc., and virtually all the unit's enlisted men are employees of the airline's maintenance or other departments.

VN-17 RD9 was the latest Naval reserve aviation division organized and is commanded by Lt. Comdr. D. W. "Tommy" Tomlinson.

Flying Boats Ordered

Contract for six flying boats costing $709,852 for the Coast Guard has been awarded to the Hall Aluminum Aircraft Co.

These planes will be of the biplane type designed for a cruising radius of 2000 miles and for a cruising speed of 110 mph.

Aircraft Bids

Proposals for the construction of 66 patrol airplanes of the flying boat type, VPB, were opened Oct. 3, bids being received from Consolidated Aircraft Corp., $6,374,073.66; Glenn L. Martin Co., $7,106,120.00; and Douglas Aircraft Co., $8,540,077.00.

* * *

United Aircraft Corp., Chance Vought Aircraft Division, submitted two proposals for the construction of VSB airplanes (scouting bombers): (1) to build 25 VSB planes for $590,484, or (2) to build 40 VSB planes for $906,760. These planes are intended for service with the Naval reserve aviation bases, and the Fleet.

Mitchel Trophy Winner

Lieut. John M. Sterling flew at an average speed of 217.346 mph, a new record, to win the Mitchel Trophy race, premier speed event of the Army Air Corps held at Selfridge Field. The previous record, 216.8 mph, was established two years ago by Capt. Fred C. Nelson.

SCHOOLS

New Courses

The General Extension Division of the University of Florida, in cooperation with the Aviation Division of the State Road Department and the Education Division of the Florida Works Progress Administration has opened a school in aeronautics.

The course is for three months and is so arranged that students may enroll for a two weeks' period, specializing in subjects such as meteorology and navigation, aircraft welding, aerial photography, etc.

Upon completion of that course, a second course for three months will be opened on January 4. This school is open to residents of any state. Tuition is $100 which includes board, lodging and glider instruction.

Students spend approximately 50 percent of their time in the various shop laboratories of the school. The engine laboratory is equipped with aircraft power plants ranging from the Curtiss OX-5 to the Pratt & Whitney Wasp. Carburetors, magnetos and accessories for all types of engines are included in the laboratory set-up. In the airplane laboratory, modern fuselage and wing sections, together with experimental types of aircraft constitute the equipment. A two place motorless plane, which has been completely designed, and which is now under construction, will be completed in the shops with the assistance of students.

* * *

Robertson Aviation School, Robertson, Mo., inaugurated a night class in mechanics, 25 students being enrolled.

* * *

The fall term at Roosevelt Aviation School started with the largest enrollment in the history of that institution, 55 students entering aeronautical training for the various courses offered in mechanics and combination flying and mechanics. While students taking flying alone may enter on any date, those taking courses including mechanical training enter four times each year. The enlarged facilities of the school in the new buildings make it possible to accept such a large class and continue the personal supervision and practical work for which this school is noted.

* * *

Student registration at Parks Air College for the Fall term is 260, a marked increase over the corresponding term of 1935. There were 99 new enrollments, 93 of which are for major courses. Registration by schools follows: Professional Flight and Executive 34; Aviation Operations and Executive 15; Master Mechanics'

(Continued on following page)

DIGEST OF RECENT EVENTS

Glider Sustained Flight Record Made in Russia

A world record for sustained flight in a glider was claimed by L. L. Kartashev of Moscow, who after cutting loose from a tow plane, glided 378 miles. The previous record was about 310 miles, established in Germany in 1935. SEPT. 22

Ingalls Makes Fast Inter-City Flights

Flying solo in her P & W powered Lockheed *Orion*, Laura Ingalls negotiated the 490 miles between Columbus, Ohio and Roosevelt Field, N. Y. in 2 hrs. 59 min. Miss Ingalls has been making a series of inter-city flights, one from New York to Indianapolis, 185 miles, requiring 61 minutes. SEPT. 25

Altitude Record Set In Stratosphere Plane

Squadron Leader F. R. D. Swain established a world altitude record when he flew a special Bristol-*Pegasus* powered stratosphere plane to 49,967 ft. over Farnborough, England. The flight lasted 3 hrs. 20 min., and broke the record held by Georges Detré by 1269 ft. SEPT. 28

Bjorkvall Makes Ocean Flight

A trans-oceanic flight which ended 1000 miles short of Stockholm, the goal, was made by Kurt Bjorkvall in a Bellanca. Taking off from Floyd Bennett Field, N. Y., the pilot had completed 2400 miles of the 3400-mile trip when his fuel supply was exhausted near the Irish coast. Bjorkvall landed in the water near a trawler which came to his aid. OCT. 7

German Flying Boats In Fast Ocean Hops

The Dornier flying boat *Zephir*, all-metal Junkers operated by Deutsche Lufthansa in experimental trans-oceanic flights, flew from the Azores to Port Washington, N. Y., in 19 hrs. 5 min., the fastest crossing yet made by these planes in this service. The distance is about 2400 miles. OCT. 7

Jean Batten Sets New Flight Mark

A new solo record for a flight from England to Australia was set by Jean Batten when she landed her Percival *Gull* monoplane at Port Darwin 5 days 21 hrs. 3 min. out of Lympne Airport, Kent. The flight clipped 24 hrs. 16 min. off the old record established last November by H. F. Broadbent. OCT. 11

World Flight By Reporter Takes 18 Days 14 Hours

Using only scheduled modes of air travel, H. R. Ekins, reporter for the New York *World-Telegram*, completed a trip around the world in 18 days 14 hours 56 minutes, the fastest time yet made by a commercial traveler. Ekins started his trip from New York, leaving from Lakehurst with Dorothy Kilgallen and Leo Kieran, who also were going around the world by air for their news syndicates, but using American-made aircraft managed to beat his newspaper rivals by a margin of 10,000 miles. OCT. 19

Passenger Service Across Pacific Is Inaugurated

Regular commercial passenger service across the Pacific Ocean was inaugurated by Pan American Airways, marking the final step in the development of transoceanic flight. Schedules call for weekly departures from San Francisco and Manila, present termini of the line, in Martin Clipper flying boats. OCT. 21

The major aeronautical event of the year — in the richest air market in America

NATIONAL AVIATION SHOW

GRAND CENTRAL PALACE
NEW YORK CITY
JAN. 28th to FEB. 6th, 1937

MANY progressive concerns in the industry have already reserved exhibition space. Applications for space, representing every division of aeronautics, are now being received. We suggest that you plan now to be represented in this important sales project which is sanctioned by the Aeronautical Chamber of Commerce and sponsored by Aviators' Post No. 743, The American Legion.

Write or wire immediately for details to:

NATIONAL AVIATION SHOW

G. A. PARSONS
Managing Director
NATIONAL AVIATION SHOW
Grand Central Palace
NEW YORK CITY
JAN. 28th to FEB. 6th, 1937

This is the Industry's Big Event!

Powered with LeBlond and Warner Motors

REARWIN LEADS...

. . . in sales of ALL planes selling from $1700 to $3500, according to latest available statistics.

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"REARWIN popularity is proof of REARWIN superiority"

You need pay only one-third down!

Write or wire for complete details TODAY!

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Here are the REASONS WHY . . .

SPEED . . . the REARWIN SPORTSTER is the fastest 70 h.p. or 85 h.p. airplane built in America
APPEARANCE . . . graceful lines and beautiful finish
ECONOMY . . . 20 miles to the gallon at 100 miles per hour cruising
PERFORMANCE . . . Fastest take-off . . . quickest climb . . . highest ceiling . . . and slowest landing of any plane in its price class
COMFORT . . . ample head, shoulder and leg room

These features, which have made the REARWIN the fastest selling airplane in its price class are the features which YOU want in YOUR plane. Investigate the REARWIN now!

REARWIN AIRPLANES

Ninth Successful Year

FAIRFAX AIRPORT • KANSAS CITY, KANSAS, U.S.A.

ORNAMENTAL AIRPLANE PROPELLERS

2 FT. LONG 98¢ • 4 FT. LONG $1.98

Just the thing for your den or office. Built especially for decoration and bought at a price that I'm passing along to you. Both sizes are accurately designed and skillfully made of seasoned wood, heavily lacquered in airplane aluminum paint, with a compass rosette mounted in the center. Remove this rosette and mount a clock in them and they'll look swell on the wall or over the fireplace. Ideal gifts! They're going like hot cakes! *Act now!* Shipped express collect. Pin dollar bills to this coupon and mail today. I'll do the rest.

KARL ORT, 630 W. Poplar St., York, Pa.

Send me................ Propellers, 4 ft. long at $1.98 ea.
Quantity
..................Propellers, 2 ft. long at 98c ea.
Quantity

for which cash, check or money order is enclosed. I am also including a dime for your new 1936 Bargain Book. I want it back with my very first order.

Name ....
Address ....
City.............................. State.................

(Continued from preceding page)

Flight 104; Aeronautical Engineering 89 and post graduate work 7.

A series of lectures on advanced celestial navigation will be given at the Hayden Planetarium, New York Museum of Natural History by W. H. Barton and Lt. Comdr. P. V. H. Weems (ret.). Beginning Nov. 4, the course will include 24 lectures given every Wednesday evening, the first four by Mr. Barton being devoted to definitions and principles with the aid of the Planetarium equipment. This will be the first application of that equipment in an organized course of instruction of sea and air navigation in this country. Comdr. Weems will give the balance of the lectures which will be on practical celestial navigation.

M. I. T. Program

Expansion of educational activities and enlargement of facilities for student welfare are proposed in a program of objectives presented by Dr. Karl T. Compton, president of Massachusetts Institute of Technology.

The progress of aeronautical engineering in recent years was indicated in Dr. Compton's report by the statement that airplane speeds have increased so rapidly that the Institute's wind tunnel, built in 1923, is now inadequate for the purpose for which it was designed. A unique design for a new wind tunnel is planned, which will gain the advantages of a large tunnel with enormous wind velocity through the expedient of operating at an adjustable air pressure within the tunnel. In addition, it is proposed to construct a towing tank.

Personnel Changes

Four faculty members have been added to the Parks College teaching staff which now numbers 33. The new members are Charles J. Schwarz, associate professor of radio; William Richardson, assistant in engineering; Paul F. Kristan, instructor in woodworking; and Clifford H. Karvinent, instructor in the mechanics' school.

* * *

Expanding facilities of the ground school department at the Ryan School of Aeronautics to accommodate the increase in student enrollments, T. Claude Ryan, president announced the following changes and additions to the school's instruction personnel: Walter Balch, chief ground school instructor, Virgil McKinley, airplane instructor and Martin Weidinger, assistant engine instructor.

INDUSTRY

Roadable Giro Delivered

The experimental type autogiro, capable of being driven on highways as well as being flown in the air, was delivered to the Bureau of Air Commerce by James G. Ray, vice-president of the Autogiro Company of America, builders of the craft.

Ray landed in a small downtown park just north of the Department of Commerce building, and after folding the rotors back over the fuselage and engaging the tail wheel to a drive from the engine, drove down the street to the front entrance of the Commerce Department.

Pilot and passenger sit side-by-side in an enclosed cockpit the size of the average automobile coupe. The 90 hp Pobjoy engine is mounted aft of the seats, giving good visibility ahead; the propeller is in front.

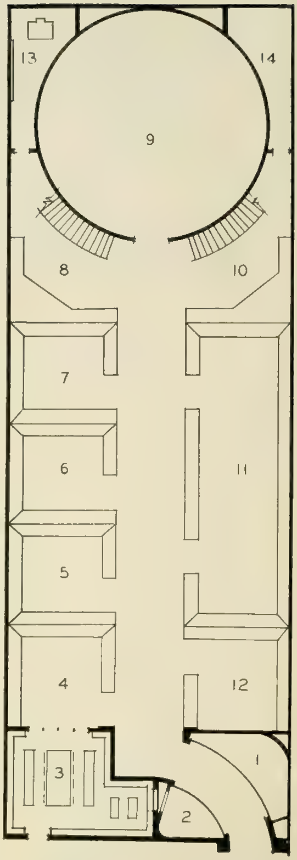
Aviation Museum

One of the most valuable and permanent aviation exhibits in this country is the Aviation Section of the Franklin Institute in Philadelphia. This section, developed under the direction of C. Townsend Ludington, already represents an outlay of some $140,000. Some of its exhibits cannot be replaced at any price, such as the early Wright Brothers model B plane and engine, which only recently was demonstrated in actual flight.

Owing to the popularity and success of this section and the rapid growth of aviation, it is now proposed to expand this section and make it the base of the first comprehensive and logically arranged aviation museum in the United States.

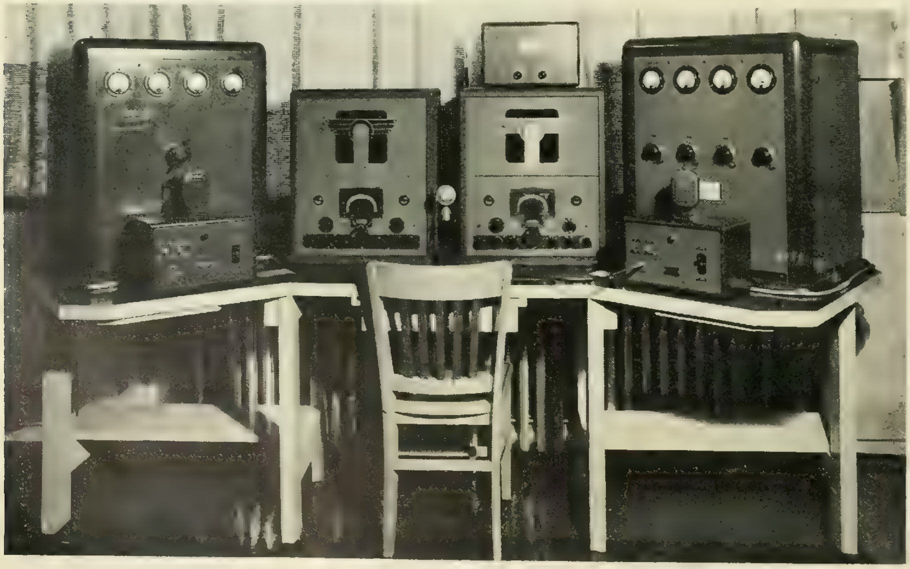
The initial step in the development of the new museum will be to erect, adjacent to the hall, a hangar which will form an appropriate setting for large planes, engines, etc.

The Aviation Hall itself will be devoted to models, dioramas, wind-tunnels and other operating exhibits illustrating the principles, history and latest developments in flight. The hall has been broken into a number of units, related exhibits are assembled in these sections, and each is given a simple popular title. The accompanying sketch of the floor plan of the Hall shows that these sections preserve a balance between the human drama and science of flight, and also between the past, present and future of the industry.



Proposed plan of Franklin Institute aviation museum: 1—Wright Kitty Hawk model 2—Plane of the month 3—Reading room and archives 4—Flight in nature 5—Feeble wings (first attempts at flight) 6—The sea of air (physics of the air; meteorology, etc.) 7—Lighter than air 8—Aerial evolution (origin of species) 9—Aeroplanarium (history of aviation) (Above) 9—Theater of air 10—Flying models 11—Why it flies (elementary aerodynamics; wind tunnels, models, etc.) 12—Autogiro, stratosphere, rockets 13-14—Electrical service and storage facilities

Models of RCA aviation radios on view at the company's aviation radio headquarters at Camden, N. J. Central Airport



As a central and dramatic feature of this hall, there has been invented a device known as the Aeroplanarium. This will do for aviation what the Planetarium does for astronomy.

Plans for the new museum have been developed by Leonard Outhwaite, consultant, working in cooperation with the Institute's officers and staff.

(Continued on following page)

BABB AIRCRAFT SALES

INTERNATIONAL AIRCRAFT BROKERAGE • U. S. EXPORT LICENSE NO. 124

ENGINES:

CYCLONES, Model SR1820-F2, new, 735 H.P. List price $8120; net each.	$6000
CYCLONE, Model SR1820-F52, 820 H.P. Same as new. List price $8600; net	6000
CYCLONE, Model SR1820-F1, 650 H.P. Practically new	3000
HORNETS, Model 1860B, geared, 575 H.P. 38 hours total time. Each..	1000
HORNETS, Model 1860B, direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each	1650
HORNETS, Model 1690A, 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each	1000
WASP SD—500 H.P. Under 100 total hours. Overhauled by P&W Factory. Equipped with controllable propeller	2500
WASP SC1's—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each....	1650
WASP C's—420 H.P. Under 500 total hours; overhauled and modified. Each	1350
WASP B's—420 H.P. Under 600 total hours; overhauled and modified. Each	850
WRIGHT R975-A's, with D modifications — 330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each	1250
WRIGHT R760-E's — 250 H.P. Majored and modified by Wright distributors. Each	1250
WRIGHT J-5's—220 H.P. Moderate usage; majored. Each	500
LYCOMING R-680—215 H.P. Majored and modified by Lycoming distributors	550
KINNER B-5—125 H.P. Newest type; factory rebuilt, with new engine guarantee	850
KINNER R-5—160 H.P. Few total hours—like new	850
KINNER K-5—100 H.P. Front exhaust. Same as new	650
KINNER C-5—210 H.P. Under 400 total hours; majored and modified.	450

SPECIAL

While They Last!

New, genuine Wright J-6 Exhaust Valves, each	**$12.50**
J-5 Exhaust Valve Guides, standards, each	**1.50**
J-5 Exhaust Valve Guides, plus tens, each	**3.00**

Following Engines in "As Is" Condition All average under 500 total hours:

No.	Type	Price Each
27	**HORNET A-1's**—525 H.P.	$500
18	**HORNET B's**—575 H.P.	850
25	**WRIGHT R975's**—330 H.P.	675
40	**CURTISS D-12's**—400 H.P.	500
18	**CURTISS CONQUERORS** — 600 H.P.	500
3	**AXELSONS**—150 H.P. 7 cylinder, air cooled	150
1	**CHALLENGER**—185 H.P.	195

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Engine parts—new and used—for Wasp and Wright engines at big discounts. Write for bulletin on bargains.

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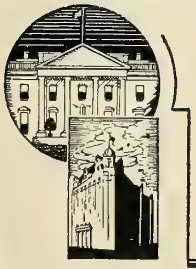
The Hayden Planetarium

announces:

A special course of 24 lectures covering the principles and practice of Celestial Navigation in cooperation with the Weems System of Navigation during the 1936-37 season, starting November 4th. The lectures, given weekly, will be held on Wednesdays in the Planetarium.

For full information concerning the course write or phone

THE HAYDEN PLANETARIUM
81st Street and Central Park West, New York, N. Y.
Telephone, Endicott 2-8500



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The Willard served as the official White House when President and Mrs. Coolidge lived here for a month during his administration . . . With its modern facilities, the Willard retains all the tradition exclusively its own.

Single Rooms with Bath $4 up
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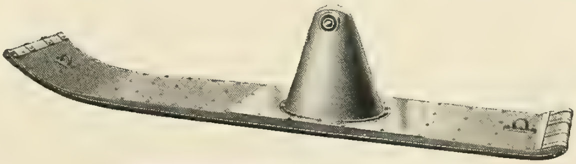

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Tapered Spruce Runners . . . Rocker shaped renewable bottoms . . . Full rubber bushed axle bearings . . . Light weight streamlined design . . . Thirteen sizes, capacities from 1000 to 15000 pounds . . . Pioneer manufacturers of Dep't of Commerce Approved Ski Equipment . . . Contractors to U. S. Navy and leading operating companies.

FEDERAL AIRCRAFT WORKS
1925 — Minneapolis, Minnesota. — 1936

(Continued from preceding page)

Export Gains

United States exports of aeronautical products for the first eight months of 1936 were more than $4,000,000 ahead of the same period in 1935, the totals being $14,216,140, compared with $10,064,625, including sales to Hawaii, Puerto Rico, and Virgin Islands.

During the period, Chinese imports reached $5,665,347, putting that country far in the lead as the best purchaser of American equipment. Next best importer was Argentina which bought $1,230,953 worth of our products, followed by Australia with $484,228 and by Japan with $455,594.

In addition to the above, countries importing more than $250,000 of American aircraft equipment were Colombia, Peru, Siam, Germany, Italy, Netherlands, Canada and Mexico.

August exports alone totaled $2,325,207 from 61 aircraft and 89 engines, in addition to $487,689 worth of parachutes, parts and accessories. During that month, Chinese imports included 25 aircraft and 41 engines. Other countries importing American aircraft during the month were the Union of South Africa (10), Canada and Honduras (5 each), Mexico and Puerto Rico (3 each), Peru and Brazil (2 each), and Australia, Japan, Argentina, Germany, Netherlands, Portugal, Great Britain and Cuba (1 each).

Arrow Organization

Arrow Aircraft Corporation, Lincoln, Neb., has incorporated with an authorized capital of $300,000, and has purchased domestic manufacturing and sales rights for the Arrow Sport V-8 along with machinery for its manufacture. Space has been leased in the Arrow Aircraft & Motors Corp. plant and at Arrow Airport for testing purposes. The original Arrow company retains the right to manufacture and sell this plane for export. The monoplane is powered by an Arrow converted Ford V-8 motor and was recently granted an ATC. Officers of the new corporation are Mark W. Woods, president; George Woods, vice-president; F. Pace Woods, executive vice-president; and John G. Aldrich, secretary-treasurer.

Information Service

Representatives from most of the cities in the San Francisco bay area, including the territory from Petalumas to San Jose, met in the Chamber of Commerce building in San Francisco to form the San Francisco Bay Area Aviation Industry Development Committee which will prepare data covering facilities for every type of air activity from private flyers to complete factories. This information will be furnished upon request. Emory Bronte is chairman of the committee.

Cub Prices Reduced

A production record which, according to W. T. Piper, president of Taylor Aircraft Co., is equal to practically 30 percent of the total number of commercial planes manufactured in the United States during the first six months of 1936, has made possible a $200 reduction in the price of the *New Cub*. The plane now sells for $1270, with an additional $28 for a cabin enclosure.

Available production floor space at the Bradford, Pa. factory of the company has been expanded considerably since the first of the year. An order for 1050 Continental 40 hp engines placed by the company was the largest non-military engine order ever written and a distributor and dealer network for merchandising the small two-place monoplane now covers the United States and some 35 countries throughout the world.

15,763 Pilots, 7747 Planes

There were 15,763 pilots and 7747 aircraft holding active Department of Commerce licenses on October 1, 1936, according to the Bureau of Air Commerce. This compares with 14,763 pilots and 7344 aircraft licensed on October 1, 1935.

Total number of aircraft licensed and unlicensed of which the Department had record on October 1, 1936, was 9621, while this number on the corresponding day of last year was 9139. Unlicensed aircraft (bearing identification numbers only) totaled 1874 on the first of October 1936.

Among the 15,763 persons holding pilots' licenses as of October 1, 1936, were 7416 transport, 881 limited commercial, 6752 private and 714 amateur. The licensed pilots included 432 women classified as follows: transport, 69; limited commercial, 25; private, 278; and amateur, 60.

Menasco-powered all-metal "Aeroeer" 25 of which are scheduled to go into production this month

Coming Events

International Aviation Show, Grand Palais, Paris, France. November 13-29

●

Thirty-seventh Annual Convention, International Acetylene Association, Hotel Jefferson, St. Louis, Mo. Nov. 18-20

●

Aircraft Show, Miami Municipal Airport, Miami, Fla. Dec. 6-12

●

"Cub Convoy" for Miami Air Races takes off from Atlanta, Ga. Dec. 8

Ninth Annual Miami All-American Air Maneuvers, Municipal Airport, Miami, Fla. Dec. 9-12

●

National Aviation Show, auspices Aviators' Post 743, American Legion, Grand Central Palace, New York. Gus Parsons, managing director. Jan. 28-Feb 6, 1937

●

Second Annual National Pacific Aircraft and Boat Show, Pan-Pacific Auditorium, Los Angeles, Calif. Cliff Henderson, managing director. Mar. 13-21, 1937

Aircraft Shows

Detailed plans for the National Aviation Show, to be held in Grand Central Palace, New York City, January 28th to February 6th, are taking shape under the guidance of Gus Parsons, managing director.

The ground floor is tentatively allotted to air transport, civil aircraft and their major components, engines and instruments. The second floor will feature light planes; the third airports, airways and accessories; the fourth floor gliders and models.

Feature exhibits of an educational nature will be strategically located on all floors to equalize attendance throughout. Among the organizations which have been invited to arrange such exhibits are the *Early Birds*, the *99 Club*, Junior Birdmen of America, Institute of the Aeronautical Sciences, NACA, U. S. Bureau of Standards; Bureau of Air Commerce, U. S. Post Office Department, the Army and the Navy.

Every day except Sunday will be devoted to some special phase. January 28 will be given over to the Aeronautical Chamber of Commerce of America; January 29 to air transportation, mail and express; January 30 to model-building discussion, gliders and soaring machines; February 1 will be Navy Day, featuring discussion of power plants and fuels; February 2, Army Day, featuring engineering design. Bureau of Air Commerce Day on February 3 will be devoted to airports, airways and marine terminals, and also safety advances. February 4 will be transoceanic day with discussion of modern flying boats and airship and their respective advantages. Opportunities in aviation will feature Forum talks on February 5 when heads of ground and flying schools will share the program with weather and radio experts, instrument builders and others concerned with navigational aids. February 6 will be American Legion Day.

Cooperating with Parsons in the show management are Casey Jones and Harold Hartney, representing the show sponsors, Aviators' Post No. 743, the American Legion, and Charles E. Parker, vice-president of the Aeronautical Chamber of Commerce of America, which sanctioned the show.

* * *

Plans for the second annual National Pacific Aircraft and Boat Show, March 13-21, 1937, indicate that the exposition will again be held in Pan-Pacific Auditorium, Los Angeles, scene of this year's event.

Following the precedent established in the first show, the entire 110,000 sq. ft. of floor space in the auditorium will be made available for aircraft and marine displays. California Air Industries Association, the sponsoring organization, has again selected Clifford W. Henderson as managing director, according to Harry Wetzel, president of the association. Phil Henderson will be business manager.

On the aircraft show committee, Wetzel has named Palmer Nicholls, Waldo Waterman, Al Menasco, Robert J. Pritchard and George T. Cussen.

According to Wetzel, application has been made for a sanction from the Aeronautical Chamber of Commerce.

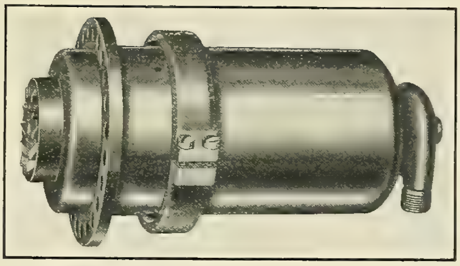
Personnel Changes

At a meeting of the board of directors of United Aircraft Exports Corp., Thomas F. Hamilton was elected president; J. Reed Miller, former treasurer of the corporation, was elected vice-president, and James J. O'Shea

(Continued on following page)

Announcing the

COFFMAN STARTER



The newest in aircraft engine starting. The Coffman Starter combines more power with lighter weight, eliminating battery drain. It insures positive starting in cold weather. Reduces priming and eliminates the need of a booster.

Built in sizes suitable for all motors 200 H.P. up to 1250 H.P. Easily mounted on Standard Starter Flange.

After months of the most severe testing in cold chamber and in service, it is now in use by the United States Army, Navy and Marines.

One touch on the starter button is all that is necessary to release the power from the small cartridge. No explosion, just smooth fluid pressure applied to your motor and you are off.

Write for Booklet No. 49

FEDERAL LABORATORIES, INC.
185 FORTY-FIRST STREET PITTSBURGH, PA.

NICHOLAS-BEAZLEY
AIRPLANE COMPANY, INC.
Everything for the Airplane Owner, Operator & Manufacturer
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Founded 1909

STANAVO
AVIATION GASOLINE
AVIATION OIL
ROCKER ARM GREASE

(Continued from preceding page) was elected treasurer. Alexis R. Stocker, who was elected vice-president last year, continues in that capacity.

* * *

James B. Fornasero, former Chief of Maintenance for Ryan Aeronautical Co., has accepted the position of factory service representative for the aeronautical division of Continental Motor Co. Succeeding Fornasero in his former position with the Ryan Company in Robert Kerlinger.

* * *

Frank Schubert, who has been assistant to the president of the Bearings Company of America, has become associated with the management of the Houde Engineering Corp., a division of Houdaille-Hershey, Buffalo, N. Y.

* * *

The Sherwin-Williams Co., paint and varnish manufacturers, have announced the following promotions: first vice-president and director of sales and distribution, H. D. Whittlesey, will be relieved of the duties of director of sales and distribution to devote his time to executive duties; vice-president A. W. Steudel becomes vice-president and general manager; and K. H. Wood becomes director of sales and distribution.

New Flying Boat Project

A new transoceanic clipper ship project for Pan American Airways is under way at the Boeing Aircraft Co., following an order for initial engineering and construction work.

The flying boats will have a gross weight of more than 82,000 lbs., and will carry more than 60 passengers, with sleeper accommodations for 40. They will have a span of 152 ft., length of 109 ft., and overall height of 28 ft. The Martin Clipper ships, by comparison, have a span of 130 ft., length of 90 ft. 7 in., height of 24 ft. 7 in., and a gross weight of approximately 51,000 lbs. Speed of the Boeing boats will range up to 200 mph.

Embodying modern streamlined design, the Boeing Clippers will be all-metal internally braced high-wing monoplanes with short stub-wing hydro stabilizers instead of the conventional wing tip floats. They will contain two full decks—an upper deck housing the control cabin, crew's quarters and baggage compartment, and a lower deck containing the passenger accommodations, galley, lavatories and dressing rooms. Passage-way will be provided through the wings to the engine nacelles for inspection and servicing of engines during flight.

First of the six new boats is expected to be completed late in the fall of 1937, the project now being in the engineering stage.

Factories

Ryan Aeronautical Co.'s new modern steel factory at Lindbergh Field, San Diego, has doubled the floor area and tripled the production capacity of the company's new Ryan S-T series, according to T. Claude Ryan, president. Under the direction of Fred Rohr, factory superintendent, the company has installed another 22,000 lb. drop hammer, additional jigs and machinery, and, with a revised arrangement of all departments, expects to increase production to a minimum of 150 planes within the next 12 months.

More than 100 employees are now on the company's payroll with some departments working on a 24-hour basis.

* * *

Russell Manufacturing Co., Middletown, Conn., has moved the Chicago office and warehouse from the south side to a convenient north side location, at 549 East Illinois St., Section 14 North Pier Terminal. Complete new office and warehouse facilities are now available for all products including pilot and passenger safety belts, rings and shock absorber cord.

Business Reports

Stockholders of Fairchild Aviation Corp. have been advised of a special meeting Nov. 2, at which they will be asked to approve segregation of the company's activities into two separate companies, the shares of one of which will be distributed to present shareholders on a share-for-share basis.

Fairchild Aviation Corp. will retain full ownership of Fairchild Aerial Camera Corp., and its interest in Fairchild Aerial Surveys, Inc.

Fairchild Aviation Corp. aircraft and engine business, and its interest in Fairchild Aircraft, Ltd., of Canada, will be transferred to a new concern, the Fairchild Engine & Airplane Corp., the shares of which will be distributed.

Sherman M. Fairchild will remain president and chairman of the board and will occupy the same positions in the new company. Vice-presidency of Fairchild Aviation Corp. will continue to be filled by James S. Ogsbury.

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STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

of AERO DIGEST, published monthly at New York, N. Y.. for October 1, 1936.

State of New York, }
County of New York, } ss.:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Frank A. Tichenor, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the AERO DIGEST, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y.; Editor, George F. McLaughlin, 515 Madison Avenue, New York, N. Y.; Managing Editor, None; Business Manager, Frank A. Tichenor, 515 Madison Avenue, New York, N. Y.

2. That the owners are: The Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y.; Frank A. Tichenor, 515 Madison Avenue, New York, N. Y.; Jessie H. Tichenor, 515 Madison Avenue, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contains statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) FRANK A. TICHENOR.

Sworn to and subscribed before me this 25th day of September, 1936.

(Signed) Charles Bergemann, Notary Public,
Nassau Co., No. 83; New York Co., No. 1507.
(My Commission expires March 30, 1937.)

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Lockheed Electra, owned by Belmont Investment Co., Los Angeles, Calif., pictured just before take-off.

RCA's AVT-12 Aircraft Transmitter ...7B and 7C Receivers...help guide this giant plane through the skies!

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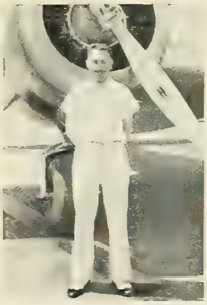

This is "Mac" MacLeod, pilot of plane shown above.

RCA Aviation Radio Instruments are sold by AIR ASSOCIATES, Inc., Glendale, Calif.; Chicago, Ill.; Garden City, L. I.; or write direct to Aviation Radio Section, RCA Manufacturing Co., Inc., Camden, New Jersey. *A service of the Radio Corporation of America.*

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FOREIGN ACTIVITIES

American-made transports are flying 22,000 miles each week in Australia

R. G. L. THOMAS

● Approximately 1500 route-miles of Australian airways are now being operated by American aircraft, although it is but a few months since the first American plane went into service. At this rate, it is expected that before the middle of next year, half of Australia's airways will be operated with American-made flying equipment.

September, 1936, saw these aircraft putting up a greater mileage than British. They were averaging more than 22,000 flying miles a week, representing nearly half the total miles flown weekly within the Commonwealth.

In New Guinea the change-over to American aircraft is intensified. Two Stinson *Reliants,* a Lockheed *Electra* and a Lockheed 12 are in commission together with a Fairchild and a Sikorsky amphibion. The three Stinson *Airliners* of Airlines of Australia are logging nearly 18,000 miles each week while the Douglas DC2 has been maintaining its daily schedule between Melbourne and Hobart with only slight interruptions. At present the run from Sydney to Townsville (twice daily to Brisbane and twice weekly from Brisbane to Townsville) is operated by Stinsons. Melbourne to Hobart is maintained by the Douglas DC2 as well as a deHavilland *Dragon.*

A second DC2 (equipped with a Sperry gyropilot) is expected to go into service before the end of the year and then the direct Sydney-Perth transcontinental route will be operated with Douglas equipment only. This route is now operated in sections, mostly with DH 84 Dragons.

The Brisbane - Darwin section of the Empire airway to London is still maintained with DH 86's and no change is anticipated on this run as Qantas Empire Airways are associated with Imperial Airways. The change for the trunk route will be made in August, 1937, when the Empire flying boats take over the airway leaving the DH 86's to maintain the present trunk route as an internal feeder to Darwin.

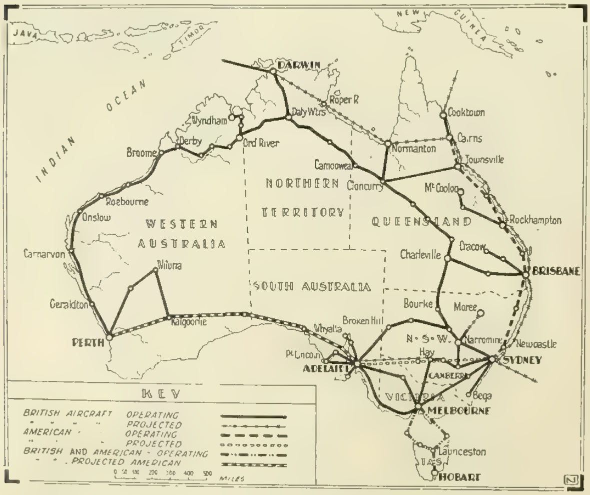
Macrobertson-Miller Co. operates the Perth-Darwin route and, as this is largely internal, the *Dragons* have provided adequate service thus far. It is expected that this company will be taken over by Australian National Airways before this year ends, in which case there is great likelihood that a few more Stinsons or an *Electra* will be purchased to operate the route if the Government will permit. Present contract calls for British aircraft.

Bids have been solicited for a service from Cooktown to New Guinea and, if Guinea Airways obtains the award, *Electras* will be used. There is, however, a possibility that Qantas will bid with an Empire flying boat in which case imperial considerations may weigh the balance in their favor. Another bidder will be W. R. Carpenter and Co., Ltd., existing holders of the New Guinea internal air mail contract who will bid with an Avro 642 and the new Australian-built *Gannet,* which is powered with two Menasco 6BS *Buccaneer* engines.

The American influence in private ownership is also apparent. A Mr. Moody purchased a Stinson *Reliant,* as has the Vacuum Oil Co., and G. Falkiner, a wealthy station owner, has purchased a de-Luxe *Waco.* Others are on order.

Reasons for the success of American aircraft in Australia are not difficult to understand. Australian conditions are similar to those in this country—vast distances and sparsely settled areas demand high speed transports which the British manufacturer has neglected. American craft meet the requirements of the Australian operator, and these make an appreciable sales impression on the Australian aircraft market.

The only major airlines operating British aircraft exclusively are the heavily subsidized routes connecting with the empire route of Imperial Airways. The reasons for the use of British craft are apparent. There are reports that the Post Office will insist upon British aircraft for future G.P.O. mail contracts, but this is not likely to happen. The Post Office is one of the few Australian government departments that runs its business efficiently and it appreciates efficiency in others.



Map of Australia showing routes traversed by regularly scheduled and proposed lines and type of equipment being operated

NEWS IN BRIEF

Australasia

Airlines of Australia have purchased Rockhampton Aerial Services Ltd., and will henceforth operate daily service between Brisbane and Rockhampton and weekly service from Rockhampton to Mt. Coolon.

Captain C. P. Scott has been appointed Superintendent of Flying Operations for Holyman's Airways, the organization, at the same time, also employing five more pilots, bringing the number of its operations personnel to 16.

Qantas Empire Airways, operating the Brisbane - Singapore route with DH 86's maintained a perfect schedule operation on westbound service for the five months ending August.

The Australian-built *Gannet,* powered with supercharged Menasco *Buccaneer* engines, underwent speed trials recently after new propellers were installed. It cruised at 151 mph and recorded a maximum speed of 180 mph.

Construction of two large hangars, a ramp, moorings for 4 flying boats, shops, buildings for passengers, mail and immigration, health and customs officials will soon be started at Durban to provide facilities necessary for the development of that city as the South African terminus of the Imperial Airways' flying boat service, soon to be inaugurated. Durban is expected to be the distribution point for mail and passengers and other traffic from abroad. Emergency landing points will be prepared at St. Lucia Lake and Kosi Bay, both in northeast Natal. An emergency landing site at Mossel Bay will be prepared and a radio station transferred there from Victoria West.

The government is calling for bids for air mail service from Australia to New Guinea on a weekly basis. It is expected that Pan American Airways will tie-in with this service with a feeder line from Guam to join Australia and San Francisco with a 7-day schedule.

Completion of the large seaplane ramp and hangar at the new civil airport at Singapore has advanced rapidly recently, most of the concrete already having been poured. The 17-ton flying boats to be used by Imperial Airways will be handled there.

In response to an appeal by the Minister for Defence, the British Air Ministry will begin filling Australia's order for 90 aircraft for the R.A.A.F., the first consignment to be forwarded in a few weeks. Orders are for 18 *Seagull V* amphibions, 36 Hawker *Demon* fighters, and 36 Avro *Anson* twin-engined reconnaissance bombers. It is planned also to have a total of 2000 officers and men fully trained and attached to the R.A.A.F. on completion, this year, of the three-year program.

The New South Wales Government will provide a subsidy of $5000 a year for the projected aerial medical service at Broken Hill. It is planned to have an airplane and flying doctor stationed at Broken Hill, the doctor keeping in touch with the base by radio.

Mascot Aerodrome has been renamed in honor and memory of Kingsford-Smith, and the govern-

(*Continued on following page*)

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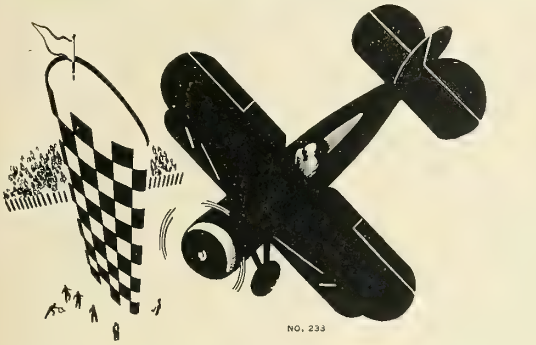

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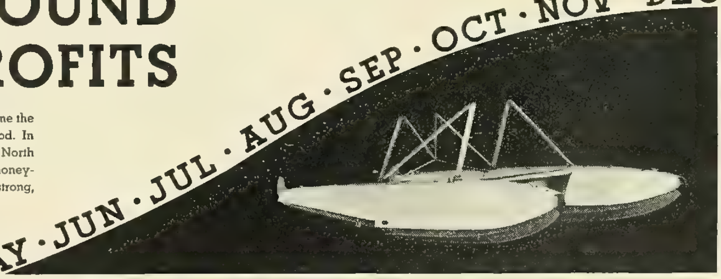

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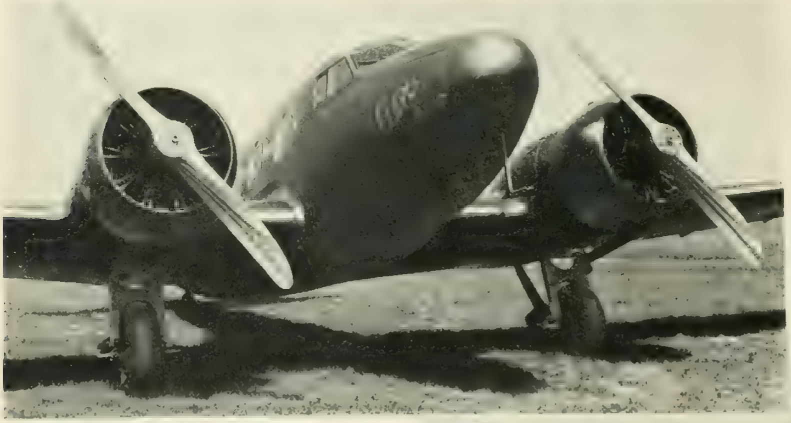
LUSCOMBE AIRPLANE DEVELOPMENT CORPORATION
Mercer Airport, West Trenton, N. J.

(*Continued from preceding page*) ment has allotted $500,000 for an administration building (with control tower), new runways and extension of the landing area.

Canada

Ten twin-engined *Monospars,* comprising the first complete fleet of British aircraft built for Canada, have been delivered to Eastern Canada Airlines for use in a new service linking St. John, Moncton, Charlottetown, New Glasgow, Sydney and Halifax. They are the first British planes designed for Canadian freight service.



Accommodating 8 passengers and 2 pilots, this Czechoslovakian Aero A-204 is powered by 360 hp Walter Polliux II R engines

The Civil Service Commission has made the following appointments for inspectors of civilian flying. Chief inspector is Dr. W. J. R. Robertson, who will have his office at Ottawa, and who will be in charge of civil flying inspections under the new Ministry of Transport. Five assistants were appointed: J. L. Blondeau at St. Hubert Airport, Montreal; Eric Billington, to serve in Edmonton; William S. Lawson, for duty at Lethbridge; Samuel Foley and John R. K. Main of Toronto, are to be directly attached to the Ottawa office.

Four *Tiger* training ships built by de Havilland were recently taken over by the Department of National Defense for flying clubs at Hamilton, Moose Jaw, Calgary and Kingston.

Regular monthly mail service will be started this month between Ile la Crosse and La Loche, Saskatchewan, a distance of approximately 96 miles. This service will be operated by M. & C. Aviation Co. under contract with the Post Office Department. Similar weekly service was scheduled to be re-established between Oskelaneo and Chibougamau, Quebec, on or about October 1; this stretch, about 130 miles, is being flown by General Airways Ltd. (Toronto).

Experimental radio and airway test flights on the Winnipeg-Vancouver link of the proposed trans-Canada airway are now being conducted. Five radio beacon stations on the Winnipeg-Lethbridge route will be tested and radio investigation through the mountains between Lethbridge and Vancouver will be carried on to determine what type of radio aid will be most suitable for flight over the Rockies. Air mail service between Vancouver and Winnipeg will probably start January 1, 1937, and the Dominion-wide service will follow as soon as possible.

Opening up an almost virgin mining country and a rich fur trading and big game hunting territory, a complete mail service for northeastern British Columbia has been authorized by postal authorities. Inaugural flights probably will be made in December, the contract for carrying the mail being awarded to an Edmonton company.

Walker Airport, on the outskirts of Windsor, has been chosen as an airport of entry. The nearest customs airport to Walker field is at Toronto.

A new 242-acre airport at Cobb's Arm near Botwood, Newfoundland, is under construction, funds being supplied by the British Air Ministry. The main runway, extending ENE-WSW, will be 4800 ft. long by 1200 ft. wide. There will be 3 other runways measuring approximately 4500 by 600 ft., the direction of each being at a 45° angle from the other.

W. J. Sanderson, president of the Fleet Aircraft Corp. of Canada, announced receipt of an order for 10 trainers from the Department of National Defence. The price is understood to be about $75,000.

Figures just released by the Civil Aviation Branch of the Department of National Defence, for the second three months of 1936, show that the 25 mail services operating carried 244,482 pounds of mail during the period in 1474 flights covering 190,660 miles.

Light airplane clubs for the first six months of 1936 had 1879 members who flew 79 planes. The 22 clubs flew 6396 hours, about half of the total flown last year. Sixty-four pilots received private licenses during the period.

Canada's trans-Canada airway development shows that at the end of June there were 37 intermediary fields available for landing, with work progressing on 22 more, and the number of sites still to be procured cut to six.

A trans-Canada air mail service will be inaugurated July 1, 1937, with the western mail service first resuming in the spring of next year. Tests have been made with radio direction-finding equipment in the Rocky Mountain section to eliminate the larger direction-finding radio stations placed elsewhere on the route. Mail will be flown from Halifax to Vancouver, connecting at Halifax with the British transatlantic flying boat mail service expected to start in the spring.

China

Southwest Aviation Corp. has been granted the franchise to operate passenger and mail service between Canton and Hanoi where connection is made with Air France. The route is by way of Canton-Wuchow - Nanning-Lungchow-Hanoi.

With the use of new and larger American planes, China National Aviation Corp. has increased its traffic on the Shanghai-Peiping and the Shanghai-Chentu routes, and plans are now under way for improving equipment on the Shanghai-Canton coastwise route. Eurasia Aviation Corp. has ordered three Junkers planes to care for heavier traffic demands. With the new Hong Kong-Penang service offered by Imperial Airways (connecting at Penang with K. L. M. or other Imperial Airways' planes) passengers can now reach London from Hong Kong in seven days.

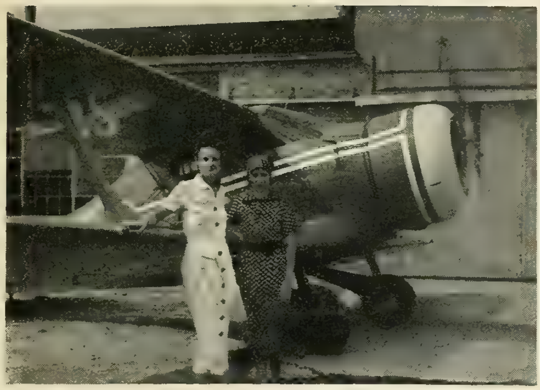
Czechoslovakia

Tri-weekly scheduled service between Prague and Moscow via Uzhorod, Kluj, Jassy, Kiev and Brjansk is now being offered, on a joint basis, by Czechoslovak State Air Lines and the Soviet Aeroflot. The 1515 miles is flown in 16 hours, the one way fare being about $66.00.

Germany

A development of the DO-X is now under way in the Dornier factory, the new plane, designated the DO-20, differing from the former in the matter of its power plant. It will have eight gasoline in-line or Diesel engines with horsepower of each ranging from 800 to 1000. Wing spread will be 161 ft., overall length 131 ft., and height 31.1 ft. Empty weight with Diesel engines will be 65,036 lbs.,

(*Continued on following page*)



WALTER BEECH, prominent manufacturer of high-performance aircraft, whose stock model, piloted by Louise Thaden and Blanche Noyes, won the 1936 Bendix Trophy Race, purchases much of his basic material from Air Associates.

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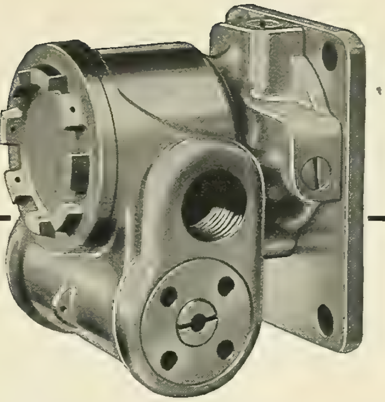

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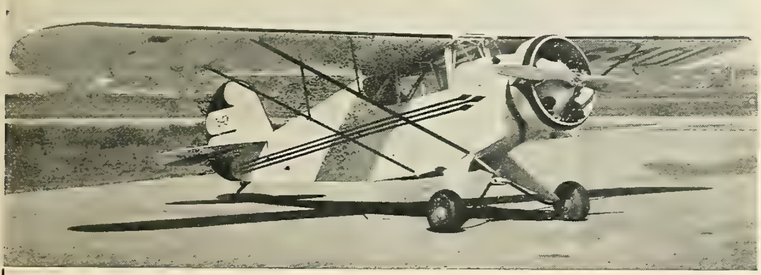

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The Italian Bergameschi "Borea" which is powered by 185-200 hp Walter engines

(Continued from preceding page)

payload (normal) 45,194 lbs., and gross weight 127,867 lbs. Maximum speed is expected to be 180 mph, cruising speed 155 mph and range 2486 miles.

Great Britain

Transport of ten passengers, their baggage and other cargo at a cruising speed of 188 mph over a distance of nearly 800 miles is the designed purpose of the Airspeed A.S.14 monoplane which is powered with two *Pegasus X* engines. The A.S.14, which is a high-wing monoplane with retractable undercarriage, is designed to reach cruising speed at 13,000 ft., with the engine delivering 62.5% of maximum output. Maximum speed, reached at 5000 ft., is 207 miles per hour.

Twenty-six new squadrons have been added to the Royal Air Force under the terms of the expansion plan announced by the Government last May. Forty-five more units must be added to bring up the strength of the Metropolitan Air Force to the 123 squadrons then proposed. Further extension to 129 squadrons, backed by full war reserves and representing a vast augmentation of the power of the Service, is contemplated.

Development of civil aviation in Great Britain is expected to be accelerated by provisions of the Air Navigation Act of 1936 which affects the licensing of air transport, compulsory insurance, provisions for airports and the central administration of civil aviation, and increases the limit of annual subsidy payments. The new act repeals parts of the old Air Navigation Act, the complete Air Transport Act (1930) and part of the Public Works Facilities Act.

Italy

An educational movement, along lines laid down by the Ministry of Aeronautics, is being propounded in Italian schools in cooperation with the Royal National Aeronautics Union. The purpose is to imbue and familiarize Italian youth with the elemental phases of aeronautics. The program provides that the first educational steps along these lines be sufficiently elemental that they may be grasped by very young children whose minds are still plastic. Simple cardboard models by the thousand, aerodynamically correct in all details, are distributed to schoolboys with the idea of arousing, from the outset, a spirit of competition. Teachers are instructed by the R.U.N.A. so that they may encourage the boys to build models and organize contests. When the primary interest has been aroused, the students receive more advanced instruction on different types of aircraft.

At the age of about 11 or 12 years, students are taught some of the rudiments of aerodynamics. At this age the boy attends the school work-shop for aircraft modeling. When a boy completes the full aircraft modeling course he receives a certificate which is recognized if he decides to take more advanced aeronautical work.

Mexico

Service between Guadalajara and Puerto Vallarta has been resumed. Two planes are employed in this service, operated by Transportes Aereos de Jalisco. Two other services are proposed. One formerly operated is that between Mexico and El Paso, via Leon, Torreon, Parral, Chihuahua. The second is between Mexico and Nuevo Laredo, probably via Queretaro, San Luis Potosi, Matehuala, Saltillo, Monterrey.

Mexico is to purchase ten military planes a year, beginning with 1937, at a cost of 1,000,000 pesos (about $280,000) to replenish equipment of the first and second air regiments. The Ministry has just taken delivery of six American-made trainers.

Civil aviation made remarkable progress in Mexico from 1929, when it first definitely started, to 1935. The number of aviation companies increased from five in 1929 to 16 last year; planes in service from 21 to 57; flying time, 21,764.45 to 31,641.18 hours; and passengers, 12,366 to 60,493.

South America

Organization and development of a Brazilian company, to be called National Air Transportation Co., has been proposed. Special attention will be given to the development of service to the interior and twin-engined, 10-passenger planes have been suggested. In the first year it is hoped five services, covering 6000 miles, would be inaugurated. Initial requirements include six transport planes and two 4-passenger planes.

Contracts have been signed between the Peruvian Government and an Italian airplane manufacturer, involving not only the sale of planes to the Government but also the construction of a plant at Las Palmas (by the manufacturer) for the production and servicing of aircraft. This factory is now under construction and the ten-year agreement gives the government the option, at the end of that period, to purchase the factory, its machinery and materials.

Sweden

The central Swedish airline between Stockholm and Malmoe, with connections for Paris and London, will be ready next year for passenger service throughout the year. It is now used only in the summer except for mail planes. Eleven emergency landing fields and twenty-five 2,000,000 cp beacons (visible in good weather for more than 40 miles) are now available for night flying.

REVIEWS OF BOOKS

●

AIRPLANE AND ENGINE MAINTENANCE

By Brimm & Boggess

Probably the first book written to cover the work of the aviation mechanic, *Airplane and Engine Maintenance* is an excellent contribution to the ever-growing aeronautical library.

It can be used to advantage by the student mechanic as a home-study reference guide, by the instructor and student as a text, and as a handbook by the licensed mechanic.

For the beginner there are practice jobs and instructions in the use of tools which, if properly carried out, should equip him for any ordinary work he might be called on to do in the trade. For the teacher, detailed instruction sheets and related information are supplied which will be of service in laying out his course. The instruction sheets are practical since they have been thoroughly tried out in shop classes and made workable by actual test. For the finished mechanic, tables and other reference data are included.

AIRCRAFT ENGINES

By Domonske & Finch

Covering the basic theory and principles of aircraft engine design and operation, this book should serve as an accredited text in engineering courses, inasmuch as its scope includes the most essential data, intelligently and accurately presented. It forms a collection of material, largely new, which should prove valuable to anyone concerned with design, construction, operation, or maintenance of engines.

Appearing at a time when existing texts were out-dated by the tremendous advancements made in design and construction, *Aircraft Engines* includes considerable new information which heretofore has not been presented in text-book form, and which is important for a complete appreciation of the aircraft engine, its capabilities and restrictions.

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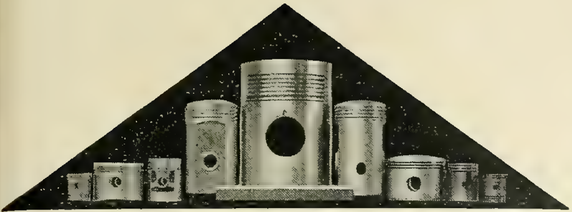
Written to supply a comparatively inexpensive, but sufficiently complete work, the publication contains information, which while primarily for the user of oil engines for automobile, stationary and marine craft, still informs the reader of applications to other types of Diesel engines.

Practical information includes engine adjustments, troubles and their remedies, fuel pumps and injectors, starting and slow running, fault location and cure. Particularly apropos is the fault finding chart which should allow rapid diagnoses of Diesel engine troubles and in suggesting remedies.



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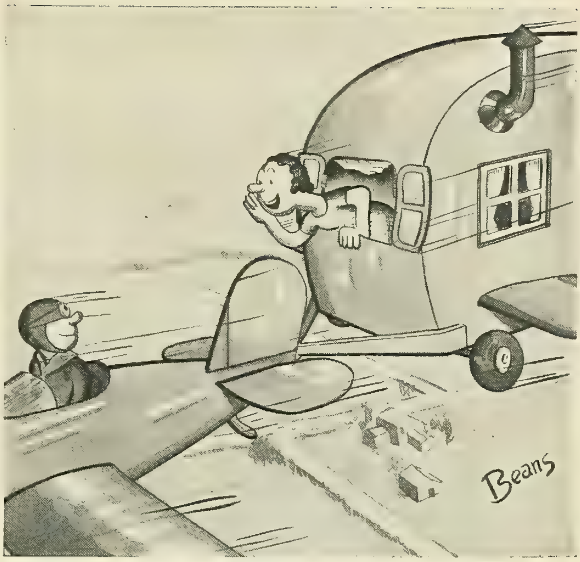

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ITALIAN MILITARY PLANES

(*Continued from page* 24)

a top speed of 137 mph and a service ceiling of 16,400 ft. Empty weight is 4070 lbs. and fully loaded 6270 lbs.

The twin-float Ca 111 long distance reconnaissance monoplane is similar to the Ca 111 except that it is equipped with an 830-970 hp *Asso* 750 *R.C.* engine. Identical in other respects to the land plane, this type has a top speed of 174 mph, a maximum ceiling of 21,320 ft., and a range of 620 miles, with a gross weight of 12,540 lbs.

The Macchi M.C.77 was designed by Ing. Comm. Mario Castoldi, chief engineer of the company which built the M.C.72, the world's fastest plane. The M.C.77, a single-engined bombing and long distance reconnaissance flying boat, is of excellent aerodynamic design with well faired wings and cleanly streamlined turrets both in the bow and aft in the hull. The engine nacelle, mounted on two parallel *N*-type struts well above the single step metal hull, supports a 750 hp *Asso* 18-cylinder W-type engine driving a pusher type propeller. The single piece wood wing of cantilever design, tapers in chord and thickness, and attaches to the top of the hull. The revolving bow turret mounts two Lewis guns as does the second turret located midway between wings and tail. The pilot's position is directly beneath the engine nacelle and in the leading edge of the wing. Bombs are stowed in the wing roots on either side of the main float. An estimated top speed of 160 mph is obtained with the 750 hp *Asso* engine. Range is approximately 1,500 miles, and fully loaded the M.C. 77 weighs 10,560 lbs.

The twin-hulled Savoia S-55 flying boats which attracted interest in the United States several years ago, are in active service in increasingly larger numbers. Designed for torpedo carrying or heavy bombing, the S-55 can carry a maximum useful load of 8800 lbs. with the two 700 hp Fiat A-24R 12-cylinder V-type water-cooled engines mounted in tandem above the center of the wing on twin *N* struts. The thick cantilever all-wood monoplane wing is divided into three sections having 18 subdivided watertight compartments. Two short single-step wood hulls are attached to the center section with the outer cantilever panels set at a large angle of dihedral and tapering both in chord and thickness. The cockpit is placed within the leading edge of the wing between the two hulls. In the bow and stern of each hull are Scarff-mounted machine guns. Bombs of various sizes are carried aft of the pilot's cockpit and inside of the wing. With a gross weight of 16,940 lbs. the S-55 has a maximum range 2174 miles, a ceiling of 13,776 ft., and a landing speed of 67.6 mph. Top speed is approximately 147 mph at sea level.

An analysis of the military and naval aircraft now being delivered to the Italian Air Force shows that many practical results have been obtained from the experimental and research program which has been under way at Guidonia, the "Langley Field of Italy." There, Mussolini has assembled the best scientific minds in Italy. Laboratories, modern in every respect and staffed by specialists in every form of aeronautical research, provide facilities for the development of improved methods of streamlining, control at high speeds, engine cooling, high altitude performance, and other problems which are later flight-tested at the government operated high-speed school at Lake Gorda. Direct results of this program are the many world's records held by Caproni, Macchi, and Savoia aircraft in the speed, altitude, and distance categories.

Technical development fostered by the Guidonia Laboratories, and increased production on the present war basis, may soon increase the effectiveness of the Italian air forces to such an extent that Il Duce's dream of another "Roman Empire" may not be as unattainable as many are prone to believe.

DYNAMOMETERS

(*Continued from page* 52)

entrained within the housing serves as the medium of friction between the discs and inner plates of the housing. To effect additional turbulence of the water and increased absorption capacity, the inner plates of the housing are provided with a waffle-iron surface and a series of holes are punched in the discs. Admission of the water is from the top of the housing on both sides. Discharge is made from the lower half of the housing through valve passages at various levels. The water as it is admitted to the housing is picked up and thrown outward by the rotor until it forms an annular ring, the depth of which (controlled by the selection of valve discharge openings at different levels) determines the dynamometer load. Throttling the water inlet also serves as a fine adjustment of load between different levels of discharge. The size of the rotor, spacing of the holes, and discharge openings are all coordinated in the design to assure smooth and regular change of load between maximum and minimum levels of water within the housing.

The control equipment used with the electric dynamometer is a departure from the usual type in that it permits remote operation from the engine control room. The principle of operation, however, is the same as that of the conventional manually operated panel inasmuch as the load is controlled by independent variation of the field and armature currents. Field rheostats and a selector switch which controls the magnetic contactors used for varying the resistance steps in the armature circuit are mounted on a small panel located within the engine control room conveniently near the operator. The contactors are located in the resistor room directly in front of the grid boxes, thereby doing away with long and expensive runs of cable between the contactors and their respective sections of resistance.

With this type of dynamometer equipment, existing d-c laboratory sources may be used for the voltage supply.

WINTER PREPARATIONS

(*Continued from page* 38)

The propeller de-icer which is installed on the back of the propeller hub, is a grooved ring into which flows a special glycerine solution. The ring has three outlets in the form of a small tube at each blade which reaches across the hub and points out toward the propeller tip on the front side of the blade. Centrifugal force carries the solution from the whirling ring, out through the tubes and along the entire surface of the blades, thus preventing the adhesion of ice to these parts. The amount of fluid flow is regulated by a valve in the cockpit and adjusted in accordance with the severity of the icing condition.

Also attached to the propeller is an 8-lb. duralumin spinner with a steel back plate. This cone is covered with rubber, balanced perfectly before installation, and is then bolted to the hub on the front side of the propeller. Before the take off in winter, the spinners are painted with a castor oil solution that adheres to the rubber-covered cone and thus prevents ice formation on this part. The spinner serves a dual purpose in that it protects the adjustable pitch mechanism from interference in its functioning by the accumulation of ice, and by preventing the possibility of vibration that would result from an uneven formation of ice on this assembly.

Another part of the de-icer installation is the antenna wire pull cord attachment actuated by a handle inside the cabin and operated by the co-pilot, at will, in flight.

Following last winter's operations with the use of de-icers, general acceptance of complete de-icer installation by all airlines is in the offing, and it is anticipated that this winter's operations will find all transports in this country completely equipped with ice prevention appliances.

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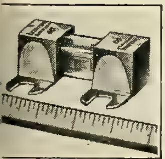

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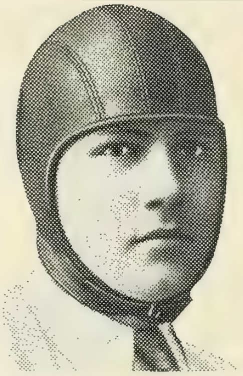

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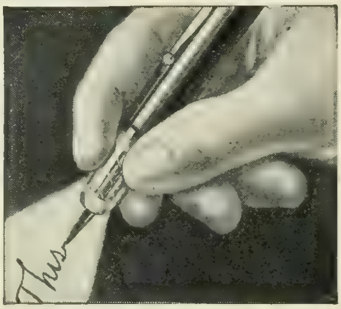

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AERONCA & BEECH (Pages 67 & 6)

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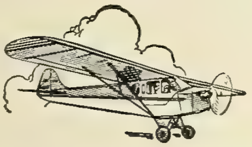

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First Prize in the Lindbergh Race
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BOEING 40-B-4, Hornet	$1,500
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FLEET, Model 2, KB-5	1,575
KINNER SPORTSTER, B-5	1,900
MONOCOUPE, Lambert 90	1,350
REARWIN SPORTSTER, LeBlond 70, Brand New	2,100
ROBIN, Challenger 185	1,050
TRAVEL AIR MONOPLANE, J6-9 "D"	2,650
TRAVEL AIR, B-4000, J-5	1,400
WACO, PLA, Jacobs 170, 2-pl.	1,850

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B. L. Erickson
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. . . . has finally decided to give up his personal and highly desirable Stearman C3R for a larger cabin ship.

The plane is in A-1 condition and has never had a mishap. Only 150 hours since major overhaul, recovering, and bonding throughout. Has hand-rubbed lustre finish with silver wings, Fokker red fuselage with black trim.

It is equipped with swiveling tail wheel, radio receiver, retractable landing lights, flares, sensitive altimeter, turn & bank, rate of climb, clock, folding chart table, as well as complete flight and engine instruments on *both* cockpits.

An ideal ship with large capacity for extended, dependable cross-country flights.

THE VIKING FLYING BOAT CO.
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J6-9 LAIRD

This airplane was purchased new and has been flown and owned by one man. The ship is perfect in every detail and has only 247 hours guaranteed total time. Equipment consists of electric starter and battery, navigation lights, Pioneer turn and bank, rate of climb and adjustable pilot seat.

This airplane cruises at 135 miles an hour, is three-place and is equipped with a Wright E engine fully modernized.

The finish is highly polished and hand rubbed and the color combination is black fuselage with bronze wings and tail group.

We will consider trades and can finance a reasonable amount.

Price: $2,975 flyaway St. Louis, Missouri

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Lowest Prices *Best Service*

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the following certified used planes, which have been traded in on 1936 WACOS.

WACO Cabin, 1934: 225 Jacobs; landing lights, radio, large tanks, special paint.

WACO Cabin, 1933: 210 Continental; excellent condition, motor majored; landing lights, flares.

WACO Cabin 1933: 210 Continental; just relicensed; special price. Extras: Turn and bank, rate of climb; landing lights, flares.

STINSON 1934: Lycoming. Controllable propeller, flaps, landing lights and flares, special paint. Socony-Vacuum red and cream.

WACO J-5 Straightwing: Good condition; motor just majored; real bargain.

Trade or terms to responsible parties

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1935 RANGER FAIRCHILD "24" has just been entirely refinished at factory. Landing lights, RCA Radio. As good as new. Price $4,000.

1935 CUSTOM WACO. High Compression Continental Engine built to Army specifications, landing lights, flares, large tanks, RCA Receiver. $4,300.

1933 CABIN WACO. Continental Engine just completely overhauled and modernized at factory. Landing lights, flares, bank and turn, rate of climb, steel propeller and hand rubbed finish in good condition. $3,300.

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S-39 SIKORSKY

in excellent condition

Just rebuilt and remodeled, with latest streamlining. Cruising speed, 110 m.p.h. 400 hp. Pratt & Whitney engine; radio, blind flying instruments complete. Extra gas tanks.

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FORD trimotor, Wasp C engines, 17-place, $7,500. WACO Cabin, late 1934 model, Jacobs 225 engine; flares, lights, electric starter, generator, radio, bank and turn; motor just majored and modernized. Bargain for immediate sale, $3,250.

TRAVEL AIR 6000-B: 6-pl. mono., J-6 330-D engine; lights, starter, A-1 condition throughout, ...$1,900.

STINSON JR. SM8A transport: Lycoming engine; lights, bank and turn, rate climb, electric starter, good condition $1,300

TRAVEL AIR Speedwing biplane: (Real speedwing); J-5 motor, Townend ring, pants, landing gear streamlined, bank and turn, 90 hours on motor since major overhaul; fabric perfect; tops 140 mph. $1,350

WRIGHT J6-7-D engine: Just major overhauled by large airline. $650

Wright J-5 motors, $350. New Bendix wheels and brakes, 30x5, 32x6; pair, $25. Two new Goodyear 35x15.6 airwheel tires, $25 each. J6-7 steel propeller, $98; J-5 steel propeller, $98. J-5 parts, used, serviceable, 80% off list.

Terms to responsible parties

LESLIE G. MULZER
Norton Field Columbus, Ohio

ENGINES FOR SALE

1 Pratt & Whitney Wasp SC1; 450 h.p.
Completely overhauled and fully modified. Forged pistons, D cam, KE valves; no time since overhaul of standard cylinders. Engine run in and tested. Price $1,650

1 Pratt & Whitney Wasp B; 425 h.p.
Completely overhauled; total time 800 hours; all parts standard size; run in and tested. Price $800

1 Wright Whirlwind R-975E; 330 h.p.
Completely overhauled and fully modified; all parts standard size. Total hours 500; engine run in and tested. Complete with exhaust manifold. Price $1,950

2 Wright Whirlwind R-975D; 330 h.p.
Completely overhauled and modified; all parts standard size. Total hours 700. Complete with exhaust manifold. Engines run in and tested. Price $1,650

1 Continental A-70; 165 h.p.
Total time 100 hours; engine just top overhauled. Complete with exhaust manifold. Price. . . .$650

1 Wright Cyclone R-1820E.
This engine has had very little time, but is in need of a major overhaul. Price, as is, $750. We believe that this engine can be overhauled and reconditioned for a cost of approximately $300.

All above engines overhauled in Pacific Airmotive Shops.

All prices f.o.b. Burbank, California
Reconditioned propellers available for all type engines.

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AEROMARINE KLEMM: LeBlond 65; just majored. Airwheels, air speed; never cracked; requires little work for relicensing. $250. Rock's Flying Service, Bristol, Vermont.

Aeronca

'35 AERONCA C-3: Like new; less than 100 hours. Brakes, compass, cabin heater. Always hangared, privately owned. $1,300 cash; no trades. K. D. Gatliff, Williamsburg, Kentucky.

AERONCA LOW WING: Powered latest type 85 LeBlond. Cabin ventilator, air brake, standard instruments; 70 hours total time. Perfect condition, never damaged. Due to financial reason will sacrifice for $2,200. Ashland Flying Club, P. O. Box 735, Ashland, Kentucky.

AERONCA C-3: New June, 1935; 325 hours; majored at factory 85 hours back; perfect condition, always hangared; standard equipment plus compass; 113-C motor; $1,000. Bert Wick, Devils Lake, N. Dak.

FOR SALE: 1936 Aeronca high wing; 100 hours total time. Always hangared, never cracked. Navigation lights, dual throttles, cabin heater, oversize tires. A real bargain for quick sale. Consider trade on Stinson S. Sunset Airways, Chambersburg, Pa.

AERONCA 1936 MASTER: Late type motor bearings. Like new. Low time. Picture obtainable. Price, $1,200; $200 down. Balance monthly. Aviation Finance Company, Hemlock, New York.

LATE 1934 AERONCA C-3: Excellent condition; air speed, compass, oleo landing gear, landing and navigation lights. Will sacrifice at $750. AERO DIGEST, Box 2442.

C-3 AERONCA: Cabin 1935 with late type motor. 40 hours since overhauled. Licensed to Sept. $800 cash. John M. Donalson, Municipal Airport, Birmingham, Alabama.

FOR SALE OR TRADE: '35 Aeronca, new condition. Streamline wheels, brakes, heater, compass and enclosure. Motor modernized to "C". $1,000 or trade for larger ship. A. R. Seaman, Jr., 3960 Wieuca Road, Atlanta, Georgia.

AERONCA SEAPLANE: Excellent condition; especially prepared for salt water; $1,000 cash. Viking Airport, Inc., P. O. Box 3302, Miami, Florida.

LOW WING DEMONSTRATOR: 85 hours total time and in perfect condition. Extras include: special instrument panel, bank and turn, rate of climb, Jaeger clock, flap, flares, battery, navigation and landing lights. Will sell with or without extras. Priced for cash sale only. Basil Aviation Co., Somerton Airport, Somerton, Pennsylvania.

PIONEER OFFERS largest selection of used Aeroncas, low in price, easy terms; see us first; write, wire or call Pioneer Aviation Sales, Airport, Syracuse, New York.

1934 AERONCA C-3: Not a lot of time. Motor and airplane in good condition. Just relicensed. Winter enclosure and brakes. $950. C-3 Master Aeronca: Licensed to June 15, '37. 565 hours. With brakes. Excellent condition. $1,100. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

1936 HIGHWING AERONCA: Only 130 hours total time; never damaged; lights, compass, and skis. Priced right. Chicago Aviation Corp., Glenview, Illinois.

Arrow

ARROW SPORT: Kinner K-5, 100 h.p., in good condition. Duals. Licensed. $700 cash. Roy P. Hiltner, Continental, Ohio, Route 1.

ARROW F: 2-place monoplane, powered by aviation conversion of Ford V-8 engine, selling for $1,500. See your nearest Pennsylvania dealer or G. D. Kelsey, Philadelphia Municipal Airport, distributor.

American Eagle

AMERICAN EAGLE: 3POLB, OXX-6 engine; Scintilla magnetos, new Sensenich propeller. Just relicensed. Ship OK in every respect. $400. Skycroft Airport, Route 3, Wilmington, Delaware. Phone: Hollyoak 876-W.

OX-5 AMERICAN EAGLE: New prop; motor turns 1400; licensed; covering excellent. Price, $325. Will deliver for expenses. W. W. Woodruff, R.D.2, Alexandria, Va., Phone: Alexandria 1196-J.

AMERICAN EAGLE OX-5: Licensed to September, 1937. Ship and engine in excellent condition; $400 cash or trade in on 2-place cabin monoplane. Chet Heinzel, 427 Fifteenth Ave. North, St. Cloud, Minn.

AMERICAN EAGLE: Model 201. Kinner powered. Excellent condition. Licensed July, 1937. $850. Reason for selling: dissolving partnership. Real buy. James Corelis, 201 Third Avenue, Moline, Illinois.

FOR SALE: American Eaglet, Salmson motor. Engine just overhauled; ship licensed. M. N. Brann, Vesper Street, South Hempstead, New York.

201 AMERICAN EAGLE: Kinner; A-1 condition; $850 with steel prop, $750 with wood prop. Position lights, compass, duals, standard instruments. V. J. Nichols, 416 21st Avenue North, Minneapolis, Minn.

AMERICAN EAGLE: Kinner. The long nose job with a K-5 Kinner. Steel propeller. Priced to sell. $550. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

Aristocrat

ARISTOCRAT: 3-place cabin; Warner 125 h.p. motor; 25 hours since major. Licensed to June, 1937. In excellent condition, many extras. Reasonable. Paul Lonquich, 164 South Broadway, Yonkers, New York.

FOR SALE: Warner Aristocrat; total time ship and motor, 200 hours; fabric and general condition excellent; rate of climb, bank and turn, metal prop, etc. $1,000. R. W. Simpson, 431 Cross Street, Westbury, L. I., New York.

Bellanca

BELLANCA CH 400 SKYROCKET: 6PCLM; ATC 319; serial number 619; licensed to June 15, 1937. Wasp C 450 h.p., 10 to 1 blower; 2 three-minute flares; landing lights; Stromberg-Carlson radio. Ship in excellent condition. Priced for quick sale. Leonard Air Service, Long Beach, California.

BELLANCA SKYROCKET: In A-1 condition, equipped with wheel pants and radio. License just renewed. Priced for quick sale. Western Light & Telephone Company, Huron Building, Kansas City, Kansas.

BELLANCA SKYROCKET, 450 h.p. Wasp, 10-to-1 blower; major overhaul October, 1936. Built late 1932. 80 gallons extra gas, gives 1,000 mile cruising range. Sperry horizon, gyro, General Electric compass, in addition to all usual engine and blind flying instruments. Parachute seats. Radio. Pontoon fittings. Many other extras. Ship will be flown to South America in January and February. Can be delivered in almost any South or Central American country without extra charge. If not sold there, will be available here in March. Marvelous ship, reasonably priced. Dealers' and exporters' inquiries invited. W. B. Harding, Holmdel, N. J.

Buhl

BULL PUP: About 100 hours on ship and motor; never damaged, excellent condition; only 5 hours since complete major on motor. Licensed to June, 1937. Private owner, wire or write. Price $475 cash. AERO DIGEST, Box 2436.

BUHL PUP: Szekely powered; licensed to January, 1937. Unusually good condition. $445. $245 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

BUHL PUP: Short wings, many extras; NC license. Reasonable. Berk-Ad Bureau, Great Barrington, Massachusetts.

Bird

BIRD A: Millerized OX-5; air wheels, brakes and complete instruments. Three-place. K. C. McAllister, 3107 East Kellogg, Wichita, Kansas.

BIRD: Kinner K-5; excellent condition; semi-airwheels and lights. $950 or will trade on Stinson S or SM8A. Gordon Kilmer, 829 Leith, Flint, Michigan.

Cessna

125 WARNER CESSNA: Licensed to September, 1937. Eight hours since motor overhaul; pants, full NACA cowling, semi-airwheels, brakes, tail wheel. Fabric excellent, high gloss finish. Consider recent Monocoupe or Fairchild. Peter Anderson, Palwaukee Airport, Mt. Prospect, Illinois.

SIEMENS CESSNA: Airplane and engine in A-1 condition; licensed till July, 1937. Dual controls, new upholstery, air wheels and brakes; also wired for lights and radio. Ideal ship for student or cross-country work. Must sell; $700 cash. Write Sam Schneider, 2169 East 47th Street, Brooklyn, N. Y.

Command-Aire

TWO COMMAND-AIRES: Challenger motor just majored, ship relicensed. OX-5 motored, licensed and best buy in section at $350. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

COMMAND-AIRE: OX-5, 3POLB; licensed until May 15, 1937. Miller overheads just overhauled; duals; red and orange paint; bargain, $325. Robert Underwood, Randolph, New York.

Corben

CORBEN BABY ACE: A-1; great for building time; built November '33. $375. Swap 30 Szekely for 45 or Salmson. Eugene Dallman, Janesville, Wisconsin.

Cub

TAYLOR CUB: 1935 model, A-40-2; 260 hours, 10 hours since completely overhauled. Speed indicator, special oiling system, compass and clock. Will trade for automobile. Will finance ship. Charles C. Giles, Clinton, S. C.

TAYLOR CUB E-2: 1934 model, just completely overhauled and relicensed. $700 or will trade. H. Maurer, 6838 South Peoria Street, Chicago, Ill.

CUBS: 1936 Bronze; extras including pitot airspeed, lights and battery, 300 hours total, excellent condition, $1,160. Also brand new demonstrators, roller bearing wheels, large tires and A-40-4 engine. Somerset Hills Airport, Basking Ridge, New Jersey.

FOR SALE: 1936 new Cub, same as new; $1,095. Terms, one-third down, balance 12 monthly payments. S. R. Guest, Congressional Airport, Rockville, Maryland.

YOU CAN DO BETTER at Al Bennett's either buying a used plane or trading in your old one. Triple your winter business in a warm Cabin Cub, adapted to skiis in ten minutes. Bennett Air Service, Hightstown, New Jersey.

TAYLOR CUBS: 1935 E-2 Continental A-40-2 with enclosure, $950. Another E-2, just recovered, $1,000. 1936 A-40-3 Cub, $1,200. 20% down payment accepted; balance financed. Aviation Finance Co., Hemlock, New York.

TAYLOR CUB: Brand new; latest series. Factory delivery October. Will sell at reduction, consider trading popular light car. Finance reasonable balance. I. Walter Sell, 566 Vine Street, Johnstown, Pennsylvania.

TAYLOR CUB E-2: Perfect condition; always hangared; just top overhauled. $800. James Cronenwett, Pittsburgh-Butler Airport, Butler, Pennsylvania.

TAYLOR CUB: 1936 Model; 3 months old; 115 hours total time; perfect condition; $1,125. P. R. Witcher, Farmville, Virginia.

1935 MODEL TAYLOR CUB E-2: Continental A-40-3; compass, enclosures; motor majored by factory recently; just relicensed; $875. Lester O. Jolly, Devils Lake, North Dakota.

Cub

1935 CUB: Under 400 hours total time and in A-1 shape. Licensed till June '37. A-40-3 engine now being majored. Ship never cracked and now being reconditioned. New cowling, new pyralin (including winter enclosure), new tires, new shock cord, etc. Price $825, cash only. Basil Aviation Co., Somerton Airport, Somerton, Pennsylvania.

TAYLOR CUB 1936: Two months old. Like new and only flown a few hours. $450 down and balance on payments. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

TAYLOR CUB 1936: Brand new June 26th, and still in excellent condition. Color yellow with black trim. Buying larger plane, reason for selling. A real buy at $1,150; finance can be arranged if necessary. Manager, Sunbury Airport, Sunbury, Pennsylvania.

J-2 CUB: 5 months old. Air speed, exhaust collector and carburetor heater. Excellent condition. $1,085. Will finance. Akron Airways, Airport, Akron, Ohio.

TAYLOR CUB: 1935 model; Rearwin 7000 demonstrator with extras; Waco de luxe cabin 1934, Continental modernized; all perfect. Michigan Aeronautical Corp., Ypsilanti Airport, Ypsilanti, Mich.

$400 STARTS YOU in aviation with a splendid used Cub. Looks and flies like new; only a year old. Balance only $45 monthly. Flying course included if desired. Don't wait; just wire deposit. We can deliver reasonable distance. Bennett Air Service, Box 247, Hightstown, New Jersey.

Curtiss Robin

OX-5 ROBIN: Duals. Licensed to August 1937. Fuselage recovered; new Flottorp propeller; Bosch magneto. $400 cash, no trades. A good buy. Aurie Antilla, Camp Round Lake, St. Ignace, Michigan.

CHALLENGER ROBIN 185: Motor and ship completely reconditioned. Special two-tone finish. Speed ring, starter, brakes, steel prop, steerable skid, duals. Absolutely perfect. $1,100. Mickie Soland, 1003 Louisiana, Houston, Texas.

CHALLENGER DE LUXE Robin: Airwheels, air starter, duals, clock. Ship and motor perfect condition. Motor just majored, total time 600 hours. Licensed to November 1, 1937. Cash only, no trades; $750. John Siems, Columbus, Nebraska.

CHALLENGER ROBIN: All blind flying instruments, flares. Motor just majored. Landing lights, new tires and tubes; covering good. Privately owned; price, $895. Box 674, Shreveport, La.

ROBIN CHALLENGER: Just relicensed, $800. Gypsy Moth, licensed, good condition, $600. Will accept trades. Air Service, Inc., Johnstown, Pa.

ROBIN CHALLENGER: 20 hours since complete recover. New engine installed. Engine has only 120 hours total time. Hamilton propeller, landing lights, brakes. $1,095. $550 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

ROBIN OX-5: Licensed; airwheels, climb, bank-turn, airspeed, battery, lights, duals, compass. Excellent condition. $550. John Hedrick, Hoosier Airport, Indianapolis, Indiana.

CHALLENGER ROBIN: Excellent condition. Duals, standard instruments, good wheels. Always hangared, never cracked. 375 hours total. Licensed June 1937. At Springfield Airport. L. B. Smith, Holyoke, Mass.

CHALLENGER ROBIN: De Luxe 3-place; Heywood starter, steel propeller, airwheels, brakes, special upholstery and cabin fitting. $850. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

Curtiss-Wright

FLEDGLING: Challenger-powered. Excellent condition. Motor 320 hours total. Dual instruments, semi-air wheels, spare disassembled Challenger motor except crankshaft and master rod; latest type aerial advertising banner, all fittings and over 70 extra letters. All of the above, $1.000. Write Riblet Aviation Corporation, Bears Den Road, Youngstown, Ohio.

CURTISS JUNIOR: Engine 99 hours since new; fuselage recovered; wings refinished; relicensed August. $450. J-4 Travel Air, 40 hours since major; speed ring, front cockpit cover, sliding hatch on rear cockpit; relicensed in July, $975. Might consider late light car on latter. C. R. Nuckols, Box 52, Oklahoma City, Oklahoma.

CURTISS-WRIGHT JUNIOR: Just recovered and major overhauled. Ship unlicensed but in good shape. $300. Montgomery School Aeronautics, Montgomery, Alabama.

CURTISS JR.: Completely rebuilt, recovered, motor modernized. Best possible condition. Bargain for quick sale. Air Activities, Inc., Municipal Airport, Houston, Texas.

CURTISS-WRIGHT Sedan: Steel prop, bank and turn, landing lights, Challenger engine just top overhaul. New battery. This 4-place ship is a real buy for operator or private owner. Air Activities, Inc., Municipal Airport, Houston, Texas.

CURTISS JUNIOR: Motor just overhauled. New main bearing, bearing lock rings, piston rings, etc. Licensed till June, 1937. Ship and motor have special reinforcings. Never cracked, always hangared. Must sell. A real buy, $325. Joseph Bokus, 649 East 48th Street, Brooklyn, New York.

CURTISS-WRIGHT SEDAN: 210 Kinner. 95 hours since major; ship refinished; radio, landing lights, flares, electric starter, generator; cactus-proof tires; $1,900. Richard Dixon, 3330 Barnett, San Diego, Cal.

CURTISS JUNIOR: Late type Szekely engine. Will cost about $50 to condition for license. Motor excellent. $250. Chuck O'Connor, Municipal Airport, Westfield, Mass.

Davis

DAVIS: LeBlond 65. Licensed to July. Semi-airwheels. Ship in fine shape. $550. Bob Souers, R. D. 5, South Akron, Ohio.

Eaglerock

EAGLEROCK CHALLENGER: Good condition. Licensed May 15, 1937. Airwheels. Priced quick sale, $700. Deliver within 500 miles. Trade for lighter ship. John K. Phifer, Wheatland, Wyoming.

J-5 EAGLEROCK: Perfect condition; licensed to July, 1937. Many extras, including steel propeller and tail wheel, $900. Challenger Eaglerock: Perfect, licensed to October, 1937, $850. Cecil Coffrin, Hangar 6, Floyd Bennett Field, Brooklyn, New York.

EAGLEROCK, $65: Less wings; excellent OX-5 less actions; complete with instruments and center section; needs covering. First $30 deposit holds ship. No inquiries answered. Clyde Renfro, Hereford, Texas.

Fairchild

BEST 7-PASSENGER Fairchild 71 seaplane in East: Large payload; supercharged Wasp SC1, completely rebuilt at Pratt & Whitney factory in August; Eclipse electric starter and generator, new special type propeller; photographic apertures; landing flares; landing gear and wheels, etc. Wasp propellers, Wasp B, total time, 550. AERO DIGEST, Box 2435.

FAIRCHILD 24: New November 1933; two-place cabin, Warner 125 motor. Total time 270 hours. Never crashed up. Always privately owned and in excellent condition. Splendid buy at $2,000. No trade. E. P. Elmore, Oneonta, New York.

FAIRCHILD 22: Inverted Rover engine, 75 h.p., major overhauled 10 hours ago. Ship never crashed. Original fabric. Always hangared. Total time, 820 hours. Delivered anywhere for cost. Price, $1,200. Best offer takes it. B. I. Gamble, 4915 Frankford Avenue, Philadelphia, Pennsylvania.

FAIRCHILD 24: 2-place cabin. Cirrus motor. Good condition, never scratched. Price, $1,250. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

FAIRCHILD 24: Warner powered. 147 hours total time. Ten months old, privately owned. Rate of climb, turn and bank, starter and navigation lights. $3,750. $2,500 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

FAIRCHILD: Sport model 22, Warner powered; speed ring, pants, tail wheel, electric starter, generator and radio. Ship yellow trimmed with black. 200 hours total time. Jesse Jones, Lancaster, Penna.

FAIRCHILD 71: Brand new year ago; worth then $13,500. Fine photographic ship. 240-gallon gasoline tanks. 2500 pounds useful load. $5,500 with skis, wheels. Alton Walker, 600 Graphic Arts, Kansas City, Missouri.

UNUSUALLY HIGH allowance on your old ship, on a new Fairchild. Air Activities, Inc., Municipal Airport, Houston, Texas.

FAIRCHILD 24: Warner motor; 192 hours; 10 months old. Flaps, landing lights, flares, turn and bank, rate of climb; completely shielded for radio; original cost over $6,000; price, $3,800. Leech Aircraft, Inc., Roosevelt Field, Mineola, New York.

Fleet

KINNER FLEET: Front exhaust; air wheels, duals, standard instruments; top overhauled; new fabric; price, $1,175. Harry L. Moehlman, Elyria, Ohio.

FLEET KINNER K-5: Front exhaust. Recently recovered. Major overhauled. Air wheels, standard instruments. Perfect condition; excellent performance. Highest cash offer accepted. Scintilla magneto in factory case, $60. H. C. Holtz, 3454 N. Frederick, Milwaukee, Wisconsin.

FOR SALE OR TRADE: Warner Fleet, 100 hours since major, complete with bank and turn, sensitive altimeter, steel prop, airwheels. Licensed to October, 1937. $1,150, or will trade for late type Monocoach or similar ship needing repairs. Also have new Warner 125 h.p. wood prop and pair 27-inch General streamline brake, wheels. A. R. Ricks, 1442 Rhode Island Avenue, N. W., Washington, D. C.

Great Lakes

GREAT LAKES: Licensed to July, 1937. Good condition; air wheels, air speed, extra motor for parts; also Butler Bros. all-steel hangar; $1,250. Lloyd Schreiber, 16 First Avenue South, Faribault, Minn.

GREAT LAKES 2T1A: New engine, brakes, wheel pants, mail type windshield; metal covered to rear cockpit; excellent condition throughout; $1,200. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

Kari-Keen

KARI-KEEN LAMBERT 90: Goodyear Airwheels. Licensed to April, 1937. 480 hours. In excellent condition. Price $875. A. B. C., Cavalier, North Dakota.

Kitty Hawk

KITTY HAWK SEAPLANE: 125 h.p. Kinner; especially prepared for salt water. Completely equipped, $1,500 cash. Viking Airport, Inc., P. O. Box 3302, Miami, Florida.

Klemm

GERMAN KLEMM seaplane: Salmson AD-9 powered. Every letter answered. Will send photograph. Sacrifice at $400. Bert Brooks, 5520—23rd St., N. W., Washington, D. C.

Monocoupe

LAMBERT MONOCOUPE; De Luxe, late 1935, beautiful condition; flaps, tunnel cowl, pants, tailwheel, lights, black and orange without blemish. 146 hours. $2,250 cash; no trades. Lt. Col. C. F. Williams, Miami, Oklahoma.

MONOCOUPE, VELIE: Motor just majored. Ship just refinished, excellent condition. Beautiful blue and red paint job. Bargain for $550. $275 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

VELIE MONOCOUPE: Licensed. Excellent condition. Ship refinished; motor majored; new propeller; airwheels; duals. Bargain for cash or trade on Cub. Also 1935 Ford coupe to trade on trainer. Sig Wilson, Ford Garage, Marquette, Michigan.

MONOSPORT two-place cabin, Warner powered; beautiful condition, snappy appearance; newly licensed; motor ring, pants, etc. Will trade or give terms. Pioneer Aviation, Syracuse, New York.

LAMBERT MONOCOUPE: Engine complete major overhaul; recovered and refinished in high lustre, entire ship; special engine ring and pants; special leather upholstering; left door installed; tail wheel; price, $2,200; will consider trade; can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

MONOCOUPE D-145: Warner. Cruises 140, top 160; tunnel cowl, pants, fully streamlined; complete instruments; $2,500 cash or will trade. William Miller, Hangar 3, Floyd Bennett Field, Brooklyn, N. Y.

MONOCOUPE LAMBERT: 1934-5; total time 138 hours; has been flown privately only. In beautiful condition throughout. Just relicensed one year. Located Teterboro Airport. Price $2,100. Standard Air Service, Hackensack, New Jersey.

Moth

DH MOTH: Just recovered; motor overhauled; licensed in October. Priced to sell. Chicago Aviation Corp., Glenview, Illinois.

N-B Trainer

NB-8, $490: Licensed to March, 1937; good covering; motor majored, except for pistons. Equipped with oleo struts, new propeller, air wheels, eight day clock, air speed, bank indicator and standard equipment. Clyde Renfro, Hereford, Texas.

New Standard

$185 FOR OX STANDARD: Perfect condition; identified. 20 hours since motor and ship overhauled. Leopold Bastian, 3513 S. Jefferson, St. Louis, Mo.

STANDARD TRAINER D29A: Kinner 100 h.p.; relicensed 8-17-36. Excellent condition. $850 lowest price. R. Kerr, Patterson Heights Airport, Beaver Falls, Pennsylvania.

Parks

PARKS TRAINER: OX-5. Good condition and licensed until June 15, '37. An exceptional buy for a good cheap airplane. $450. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

Pheasant

OX-5 PHEASANT: Completely reconditioned and overhauled. Finish and covering perfect. Must be sold; best offer over $450 takes it. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

Pitcairn

FOR SALE: Finest J6-7 Pitcairn in the country. Like new. Beautiful finish; equipped for night flying. Radio, tail wheel, electric starter, semi-air wheels; also instruments in front cockpit. Automatic fire extinguisher. Reasonable price, $2,500. Silvio Cavalier, Atlantic City Airport, Atlantic City, New Jersey.

OX-5 PITCAIRN: In excellent shape; licensed. Engine, covering and finish good. Ship never cracked; only $500. Montgomery School Aeronautics, Montgomery, Alabama.

J-5 PITCAIRN: Perfect condition. Two landing lights, blind flying instruments, front cockpit cover. Radio bonded. $950 cash. Must sell. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

Pitcairn Autogiro

PITCAIRN AUTOGIRO: 160 Kinner, 250 hours total time; air starter, complete sign towing equipment, including 65 interchangeable 6-foot letters; ship like new. Bargain. $900. Mrs. Jim Davis, Route 1, Box 570, Houston, Texas.

Porterfield

1936 PORTERFIELD: 100 hours. Many extras. Ship cost $2,350 new. Will accept best offer above $1,500. Walter Maier, 420 Alegra Avenue, West Palm Beach, Florida.

PORTERFIELD 1935: Perfect condition. Looks and flies like new. LeBlond 70 h.p. $1,100; $400 down or your plane traded and balance monthly. Aviation Finance Co., Hemlock, New York.

PORTERFIELD: LeBlond 70. Less 200 hours. Perfect shape, demonstrator. Speed ring, air speed, etc. Best offer over $1,000; trade or terms. Gene Lawrence, Frankfort, Indiana.

Rearwin

REARWIN SPORTSTER: 11 months old. Powered with LeBlond 70. Only 190 hours total time. Guaranteed perfect. Price, $1,685. $850 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

REARWIN SPORTSTER: LeBlond 85 h.p., brand new, all equipment. Cruises over 100 miles in 1 hour on 5 gallons. Beautiful finish. Will sacrifice for quick cash sale. J. A. Wales, Jr., 230 Park Avenue, New York, N. Y.

Rose

ROSE PARAKEET: Continental A-40-3; excellent condition. 120 hours total. Price, $875 cash. B. J. Colleran, 4429 N. Malden Street, Chicago, Illinois.

Star

FOR SALE OR TRADE: New Star Cavalier, assembled, completely recovered September, 1936. Total time on ship, 5 hours; Velie 45 hours since major. Looks and performs better than Monocoupe. First $450 takes it. Fanta-Reed Aero Service, La Crosse, Wisconsin.

STAR CAVALIER: Velie 65 with steel prop; 2-place high wing monoplane. Looks like small Bellanca. Stable, safe Cruises 100. Price, $800; $200 down, balance monthly. Picture obtainable. Just recovered and motor majored. Aviation Finance Co., Hemlock, New York.

Ryan

RYAN B-1 J-5 cabin 5-place monoplane. Motor majored and ship just recovered. Total time, 350 hours. Outperforms Stinson when loaded. Picture obtainable. $1,600; $500 down. Balance monthly. Aviation Finance Co., Hemlock, New York.

B-1 RYAN J-5: Cabin monoplane, 5-place, excellent condition; full of extras; licensed to September, 1937. $975. May consider trade or finance. Fred Rigler, 1049 Lincoln Place, Brooklyn, New York.

RYAN B-1, J-5: Licensed to February. $1,000 or trade lighter ship, air-cooled. Gerald Hull, 218 East Third, Royal Oak, Michigan.

RYAN B-5: J6-9. 120 hours since major overhaul of motor. Plane in fine condition. Completely equipped for aerial mapping; price $1,500. Now located Omaha, Nebraska, Airport. Ryan B-3: J6-9. 100 hours since major overhaul of engine; plane just reconditioned and relicensed for one year; completely equipped for aerial mapping. Climbs to 18,500 feet in 40 minutes; price $1,400. Located Teterboro Airport. Both planes owned by Standard Air Service, Hackensack, New Jersey.

Classified forms for December will

close November 18th

Savoia-Marchetti

SAVOIA-MARCHETTI S56B: 3POAmB; Kinner B-5 motor, 100 hours since new; ship same time since rebuilt and converted to 56B. Always hangared, perfect condition. Licensed until May. Price $1,750. Jack Peterson, Boeing Field, Seattle, Washington.

Sikorsky

SIKORSKY S-39 AMPHIBION: 5-place cabin, 300 h.p. Wasp Jr.; can be inspected at any time at Port Washington Seaplane Base, Port Washington, L. I. AERO DIGEST, Box 2438.

Stearman

STEARMAN C3R: J6-7 Wright Whirlwind; 225 hours since last major. Air wheels, tail wheel, electric starter, generator and radio. Instruments in both cockpits. Ship in first class condition. Licensed to May, 1937. $1,600. Westchester Air Service, Armonk, New York.

Stinson

DE LUXE LYCOMING STINSON R: New glass, tires and battery. Finish A-1. Very clean motor. $2,325. Harold Eddington, 2448—30th Street, Rock Island, Illinois.

KINNER STINSON: Few hours since major. Licensed to September 1937, with Hamilton steel propeller, Heywood starter, turn and bank, air speed, brakes, duals; blue plush upholstery; privately owned. $850. Edward Botine, Pocahontas, Iowa.

STINSON SM8A: Engine time 832 hours; 300 since major overhaul, no time since top; speed ring, bank and turn, rate of climb, air wheels; licensed to May, 1937. Very clean and in excellent condition. Price, $1,575. Fred K. Baxter, 3511 Morrell Avenue, Kansas City, Missouri.

1935 SR-6: Privately owned Stinson Reliant; NC-15122, $5.885. Cost nearly $9,000 with extras, including standard instruments plus Kollsman sensitive altimeter; Smith controllable propeller; 100 gallon tanks; flares, landing lights, RCA radio, turn and bank; red and cream finish with matching red leather upholstery; purchased new from Stinson, September, 1935; never cracked; flown by one pilot only; maintained without regard for cost, used for personal travel only. M. Reynolds, 542 South Dearborn Street, Chicago, Illinois.

STINSON J6-7: Just recovered, engine just majored. New upholstery, starter. A real buy. $1,675. $875 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON RELIANT SR-5: Beautiful condition; leather upholstery; large tanks, turn and bank, rate of climb, radio, three flares, retractable landing lights; motor has 20 hours since majored at Lycoming factory. For a quick sale: $3,300. Nathan S. Kohn, 45 Church Street, Paterson, New Jersey. SHerwood 2-3539.

STINSON SM8A: Lycoming; ship and motor excellent. Landing lights, night flying instruments, electric starter, cabin heater. $1,475. Robert G. Starrett, Sheldon, Iowa.

TRIMOTOR STINSON T Airliner: Complete night equipment, starters, turn and bank, radio equipped, spare air wheel, complete tail wheel assembly, spare motor parts, leather upholstery; excellent condition. Ship colors, Stearman red and Stinson blue. Motors and ship in A-1 condition. $2,100 cash. Wire John McClintock, 617 Collier Street, Pittsburgh, Penna.

WARNER STINSON: Turn and bank, rate of climb, steel prop, two heaters, new tires; recently factory rebuilt; motor and ship perfect condition; red and silver. Licensed to August 1937. $725. Myrtle Williams, 22333 Edison Street, Dearborn, Michigan.

STINSON S: Ship and motor excellent. Electric starter, battery, navigation lights, bank and turn, speed ring. Want Warner Monocoupe, and floats for same. Stacey Simpson, Little Falls, New York.

STINSON 6-PLACE: J-5 engine, just relicensed, good load carrier. Ideal for barnstorming. This is not junk. First offer over $790 takes it. Write for complete information. Beeler Aircraft Sales, Inc., 240 South 12th Street, Lincoln, Nebraska.

STINSON T TRIMOTOR: 10-place cabin; electric starters, full night flying equipment, spare tire, extra tail wheel assembly, metal bottom under fuselage, propellers reconditioned at factory; licensed to June, 1937. Best Stinson T in service today. Price, $2,200. J. Wolke, 901 W. Chamber Street, Jacksonville, Illinois.

STINSON U TRIMOTOR: With Wright J6-7E motors. Soundproof modern airliner, electric starters. Guaranteed perfect throughout. Real bargain, $4,750. Alton Walker, 600 Graphic Arts, Kansas City, Missouri.

STINSON SR-5: Special 1934, with flaps. Privately owned. Total time 250 hours. Never cracked. Brown with orange trim. Turn and bank, rate of climb, radio. Price $4,300; will finance half. Aviation Finance Co., Hemlock, New York.

STINSON TRIMOTOR: Model T, 11-place. Airwheels and new hydraulic brakes. Cabin newly upholstered; radio, spare tires and motor covers; $2,000. Write or wire Clayton Lemon, P. O. Box No. 2144, Roanoke, Virginia.

STINSON SM1B: 6-place; J-5 motor; tailwheel; relicensed for one year. Pioneer turn bank, rate of climb, compass; covering little over one year old; rubbed finish; steel prop, just re-etched and replated. New upholstering. $1,000; trades accepted. R. Snover, 21 Monroe, Apt. 205, Pontiac, Michigan.

FOR SALE: 330 Wright J6-9 Stinson Model 7A. New covering. A-1 condition. 1935 Cub. Taylor Aircraft Company, Bradford, Pennsylvania.

FOR SALE OR TRADE: 4 Trimotor Stinson U's, excellent condition and equipped for line flying. Also Stinson Reliant, 1934 model with flaps and full night flying equipment. Blue Bird Air Service, Municipal Airport, Chicago, Illinois.

STINSON SM8A: Licensed to May, 1937. High luster finish, red and yellow. A beautiful ship. Steel propeller, generator and starter. $1,595. $750 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON JR.: (SM7B): Wasp Jr. (300) powered. 610 hours total, including ground time; 160 since overhaul. Ship and engine in A-1 shape. Licensed till June, 1937. Starter, generator, navigation and landing lights, flares, bank and turn, rate of climb, air temperature, beam and entertainment radio, ring, pants, etc. Priced for cash only. Complete details and photograph on request. Basil Aviation Co., Somerton Airport, Somerton, Penna.

STINSONS: 1936, '35, '34 and '33 Reliants. Also SM8A models. All in excellent condition. Price range from $1,500 to $6,500. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

STINSON S: New covering; newly upholstered in buff and red. Blind flying instruments, retractable landing lights, two-band radio, flares. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

TRIMOTOR STINSON U: 12-place Airliner. Equipped with dual controls, blind instruments, night flying equipment and radio. Just relicensed and in excellent condition. Akron Airways, Airport, Akron, Ohio.

1934 STINSON: Controllable propeller, 100-gallon gas capacity; lights, flares, radio and blind flying equipment. New tires; ship excellent condition. Bruce Gimbel, 611 Fifth Avenue, New York, N. Y.

WE HAVE STINSONS of all models from 1930 to 1936. Will trade or finance. 1934 Stinson, needs rebuilding; fuselage, landing gear and tail okay; will sell with or without engine. Total time 140 hours. Chicago Aviation Corp., Glenview, Illinois.

J-5 6-PLACE STINSON: Fabric, engine and plane in excellent condition. Color, International orange, trimmed in blue. Will accept J-5 open job in trade. Akron Airways, Airport, Akron, Ohio.

Stinson

SM8A IN GOOD condition; will be licensed, $1,495. 1933 Stinson Reliant; 250 hours; always privately owned and in excellent condition. Large gas tanks, bank and turn. Licensed to July 15, '37. $3,[illegible]00. 1935 Stinson SR-6; 157 hours; Smith controllable propeller, Kollsman altimeter, bank and turn, rate of climb, Grimes landing lights, 3 electric flares, vacuum flaps, large gas tanks, leather upholstery, special paint. This ship is our demonstrator and we want to make room for one of the new models. $6,250. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

STINSON RELIANT: Lycoming SR-5E; 4-passenger de luxe; 360 hours, none since overhaul. Cream and blue. Landing lights. Blind flying instruments; wired for radio; large tanks, flaps. Priced reasonable. State Trade School, Putnam, Conn.

Swallow

SWALLOW TP: OX motor, airwheels; wired for lights. Special controls for instruction; low hours, good condition. Licensed August, 1937. $395. R. E. Siegenthaler, 915 Arch, Alliance, Ohio.

Travel Air

TRAVEL AIR S-6000-B: 30 hours since major; ship and motor in excellent condition; make offer. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

J6-5 TRAVEL AIR E-4000: Perfect condition. Rubbed finish, chromium struts. Compass, brakes, hand starter. Licensed to October, 1937. $1,400 cash. Williamsburg Flying Service, Inc., Williamsburg, Kentucky.

TRAVEL AIR 2000: OX-5; completely recovered. Ship very clean, A-1. Licensed to May, 1937; $650. Ernest Ruckl, 2028 North 65 Avenue, Omaha, Nebraska.

TRAVEL AIR J-5: 67-gallon gas capacity; just recovered. 125 hours since major on engine. New Hamilton steel propeller, turn and bank, rate of climb, Waltham clock, steerable tail-wheel. $1,275. $675 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TRAVEL AIR: 2-place sport trainer; Warner motor. Ship and motor just completely overhauled throughout. A real buy at $1,250. Photos sent on request. Bill Farly, Albany Airport, Albany, N. Y.

TRAVEL AIR E-4000: J6-5; NC9953. Completely recovered this summer. Engine majored and new type main bearing installed. 45 hours since. High gloss finish. Brakes, tail wheel, duals, steel prop, navigation lights, compass, bank turn, air speed, partial radio shielding. Never cracked. $1,400. East Coast Airways, Inc., West Hanover, Massachusetts.

PIONEER OFFERS largest selection of used, reconditioned Travel Airs, low in price, easy terms; write, wire or call Pioneer Aviation Sales Co., Syracuse Airport, Syracuse, New York.

TRAVEL AIR K-4000: Kinner K-5 powered, recently refinished and majored. Licensed until May. Bargain for quick sale. Trades considered. Lake County Airways Corp., Willoughby, Ohio.

TRAVEL AIR J6-5: Licensed to July, 1937. Semi-airwheels, steel propeller, bank and turn, rate of climb, brakes. Engine perfect condition with 125 hours since major. $1,195. $600 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Waco

WACO F: Warner motor, Hamilton steel prop. Balloon tires, brakes. Guaranteed in first class condition. Price, $1,400. Also 1936 Taylor Cub, less than 40 hours time. Will finance responsible parties and deliver either one for actual expenses. L. E. Smith, Box 564. Sterling, Colorado.

WACO GXE: OX-5, licensed. Motor just majored. Ship overhauled. New tires. 350 hours total. $425 or trade Warner Cessna or Stinson. Alton Nelson, 606 Franklin St., Decorah, Iowa.

WACO 180 HISSO: Late model, NC-629N; excellent condition. Licensed July '37. 15 hours since engine rebuilt by Heckman; brakes, factory tail wheel; spare engine. Cash or trade on Kinner Sportster, Great Lakes, Aeronca or Waco F needing repairs. Murray C. Taylor, 112 Sunset Place, Latonia, Ky.

WACO WRIGHT E-4: Scintilla magnetos, airwheels, compass; stressed for J-5; licensed to May, 1937. With 32-letter banner equipment, $750; $650 without. G. Goetzen, Box 269, Williamstown, N. J.

WACO 1934 CABIN: Jacobs 225; 100 hours since factory overhaul. Cruises 140 at 1900. Blind and night instruments. Fifty-gallon tanks. Flares, RCA two-band receiver, wheel pants; light blue. Private operation, best care. Bargain for quick sale. Plane within 50 miles of New York. AERO DIGEST, Box 2439.

WARNER WACO F: Newly majored and covered; in perfect shape. $1,450. Witch Duck Aeroplane Corporation, 2[illegible]0 Bank Street, Norfolk, Virginia.

WACO GXE: 115 h.p. Tank; new motor, ship completely majored; new prop. Extras, Bendix wheels and brakes. For quick sale, $885. Howard Stevens, 3705 Woodbine, Baltimore, Maryland.

WACO C: 210 Continental, perfect condition; never cracked, always privately owned. Priced to sell. Terms to responsible parties. C. G., P. O. Box 735, Ashland, Kentucky.

FOR SALE OR TRADE: One Waco GXE OXX-6; licensed July, 1937. In excellent condition. Prefer Cub or Aeronca; other trades considered. Ship must be licensed. Grady Montgomery, Jackson, Tennessee.

WACO F: Kinner B-5. New type heads. Covering excellent, ship in good condition throughout. A buy at $1,475. Hamilton Aviation Corp., Hamilton Airport, Hamilton, Ohio.

1934 DE LUXE WACO cabin: Wright 250 h.p., radio, bank and turn, rate of climb, landing lights, flares. Ship recovered, beautiful finish; motor and prop majored. A real buy for cash. Air Activities, Inc., Municipal Airport, Houston, Texas.

WACO GXE: OX-5; recently recovered; flashy paint job; Scintilla magneto; 26 x 11 x 6 Airwheels. Duals; excellent condition; licensed to May, 1937. Only $450; located in East. AERO DIGEST, Box 2443.

WACO GXE: OXX-6. Just recovered; motor overhauled; licensed until September, 1937. Hangared at Ashburn Field. A. O. Maland, 1935 East 71st Street, Chicago. Phone: Butterfield 4761.

TAPERWING WACO: Full engine cowling; wheel pants, wing root fairings, front cockpit cover with folding windshield; all control surfaces faired; tripod landing gear. Ship in perfect condition. Sacrifice at $1,675. C. M. Henderson, Palace Laundry, 9th & H Streets, N. W., Washington, D. C.

WACO J-5 TAPERWING: Less motor. Flashy paint job, extra instruments. Speed and collector ring, steel prop. First $950 takes it. Will take J-5 Stinson on trade. Russell chute, silk, $50. "Ace" Corben, General Delivery, Little Rock, Arkansas.

WARNER WACO F: Excellent condition; licensed June, 1937. Engine total 150 hours since new. Air speed, turn and bank; $1,450. Parks Watson, Blue Ash, Ohio.

WACO TAPERWING: J-5. Just relicensed, 136 hours since engine majored and airplane recovered. Has airwheels, brakes and front cockpit cover. $1,000 cash; no trades. Hamilton Standard metal propeller blades, design number 19B½-6, used less than 20 hours, $85. Hardy Young, Municipal Airport, Oklahoma City, Oklahoma.

WACO CABIN 1935 Custom: Less than 100 hours total time; like new; price, $4,800. Waco F, 225 Jacobs, many extras; 250 hours total; motor recently modernized at factory; price $3,500. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

WACO F-2 CONTINENTAL 165: Engine in perfect shape. Plane throughly inspected and completely recovered April, 1936. Special Berryloid hand rubbed finish. Color vermilion and silver, with scalloping on wings trimmed with black stripe. Standard instruments; steel propeller, reconditioned and etched; ring, starter, military windshield, etc. Relicensed October. Plane must be seen to be appreciated. $2,000 cash or finance. John Abiuso, Northumberland, Pennsylvania.

WACO 1935 CUSTOM: New Jacobs 1936 engine; fully equipped, including transmitter and ambulance equipment. New condition. Cost $8,800. Best offer over $4,500. Consider trades. Akron Airways, Airport, Akron, Ohio.

PIONEER OFFERS largest selection of Waco open or cabin airplanes, lowest prices, easy terms; see us first; write, wire or call Pioneer Aviation, Airport, Syracuse, New York.

WACO GXE: OX-5. Millerized; covering practically new; just relicensed, $450. Convenient payment plan may be arranged. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

210 H.P. CONTINENTAL F-2: Also 225 h.p. Jacobs F-5. Both in excellent condition with many extras. Also Taylor Cub. Altoona Aviation Corp., 2503 Union Ave., Altoona, Pennsylvania.

WACO 10: Millerized OX-5; licensed until August, 1937. Fuselage recovered Fokker red with yellow wings. Beautiful shape. $450. L. E. Pickard, Dansville, New York.

WACO F-2: Like new, powered with Continental motor; pants, ring; with or without floats. Waco C cabin, $1,850. Write, wire, call Pioneer Aviation, Airport, Syracuse, New York.

WACO A: Late 1933 Jacobs; 20:00 since major; radio, bank and turn, Heywood starter; wheel pants, speed ring; yellow fuselage, green wings; excellent condition; price, $2,000; will consider trade; can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

LATE J-5 TAPERWING: Speed ring, tail wheel, duals, front cockpit cover. Excellent condition. Consider trades; new J-5 Standard preferred. Akron Airways, Airport, Akron, Ohio.

1934 CABIN WACO: 210 h.p. Continental motor; lights, flares, and radio. Priced below the market. Chicago Aviation Corp., Glenview, Illinois.

WACO OXX-6: Scintilla magneto. Complete Miller overhead. Needs left lower recovered for license. Rest of ship in good condition. Motor excellent. $250. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

Wallace

WALLACE TOUROPLANE: Kinner 3-place cabin monoplane. Excellent condition. Stable, safe, economical. Motor just majored. Picture obtainable. $975; $350 down and balance monthly. Aviation Finance Co., Hemlock, New York.

Special Jobs

POBJOY R. 1W RACER: Motor just majored with new enclosure, prop, motor cowl and pants. Lewis Holy Name School of Aeronautics, Lockport, Ill.

FOR SALE: One Starling Imperial three-place cabin monoplane. Menasco motor. Will trade. Earl J. Rodman, Rock Rapids, Iowa.

PIETENPOL air camper: Flying condition; hangared; powered 70 h.p. air-cooled Heath motor; perfect. 75 hours total. Cash, $175. Charlie Allen, Jasper, Michigan.

DOAK & DEEDS: Menasco. 1POLB, identified. Fast and maneuverable. $650. Climbs 1200 feet per minute. Cruises 115; tops 140 m.p.h. A. A. Tatti, 2501 California Street, Huntington Park, California.

Miscellaneous Aircraft

TRAVEL AIR J6-9 S-6000-B: Motor recently overhauled; radio shielded; night flying equipment; $1,800. J6-5 Spartan 3POLB, good condition, $1,100. Kinner Bird, motor overhauled, $900. Alsop Flying Service, Springfield Airport, Springfield, Mass.

CURTISS-WRIGHT Air Sedan: Powered with J6-7-E. Completely overhauled from propeller to tail wheel. Grimes Electric retractable lights; direct electric starter, generator. Wiley flares, radio. Price, $2,750. Sikorsky S-39: Excellent condition; Grimes Electric retractable lights; parachute flares, radio; price, $8,000. Curtiss Challenger, Fledglings. Safair, Inc., Hangar B, Roosevelt Field, Mineola, New York.

WE OWN AND OFFER for sale or trade: Waco F-2 Continental, 165; steel propeller, air starter, late type landing gear. Instruments both cockpits. 300 hours total on ship and engine, 50 hours since overhaul on engine. Wasp Flamingo, metal, 8-place. Equipped for night and blind flying, motor just being majored. Kinner American Eagle, steel propeller, navigation and landing lights, battery; just relicensed. Wright 2[illegible]0 Monocoach, 4-place, 50 hours since major on motor. Equipped for night flying. Perfect condition. Excellent 165 h.p. Hartzell propeller; Lycoming engine parts. Currey Airplane Sales Company, 221 North 12th Street, Monmouth, Illinois.

FOR SALE: J-5 Pitcairn PA-6, $1,000. J-5 Ryan B-1, $900. K-5 Kinner Bird, $1,150. Store your ship with us for the winter. Low rates. Bethany Air Service, Inc., Bethany, Connecticut.

SALE OR EXCHANGE: Right prices. PT OX-5 Swallow, licensed August, 1937, newly covered, motor perfect, $350. Warner Cessna, 20 hours since top overhaul; semi-air wheels, good linen, licensed August. 1937, $950. Special built low-wing racing type plane, Warner 125 motor, just majored; steel propeller, new finish; top speed 160, cruise 140. $750. Will deliver for pilot's expenses. Photos furnished on request. Terms to responsible parties. Acme Auto Parts Company, Pontiac, Michigan.

FOR SALE: Bellanca Wasp Jr. Pacemaker and Wasp Buhl monoplane, 3POLM, cheap. Wright J6-7 engine, $500. Artificial horizon, $160. Cyclone E and F engines, $400 up. Frank Ambrose, Municipal Airport, Jackson Heights, New York.

CURTISS-WRIGHT SEDAN: 185 h.p. Challenger; new semi-airwheels, dual wheel control, electric starter, $1,200. OX-5 Eaglerock M-2: New covering, $400. Hisso Eaglerock, brakes $450. OX-5 Air King, good shape, $225. Wanted: Blade for Kinner propeller. Gustav Imm, Fergus Falls, Minnesota.

CONTINENTAL CUB: Late 1935. Just relicensed; air speed, cabin and carburetor heaters, enclosure, $975. Travel Air 6000-B: Modernized J6-9, just recovered and relicensed; will accept trade, $1,950. Towing banner for sale cheap. Iowa Airways, Fort Dodge, Iowa.

AERONCA SEAPLANE: PC-3, 30 hours since new September, 1936; extra gas tank, compass; priced reasonably; terms arranged. Waco de luxe Cabin 1935: New Jacobs motor, 120 hours on ship; hand rubbed finish throughout; full set instruments. Terms arranged. Red Bank Airport, Inc., Red Bank, New Jersey.

CHALLENGER ROBIN: Just relicensed; motor, fabric perfect; 365 hours total time. Also Buhl Pup, relicensed June; motor factory majored; perfect. Best cash offer or trade. Philip Miraglia, 208 Irvington Drive, Tonawanda, New York.

HUNDREDS OF PLANES: OX-5 jobs, $75 up. Terms, trades. Send 25c for complete directory containing owner's price, name and address. Used Aircraft Directory, Athens, Ohio.

OX-5 WACO 10: Good condition all around; just relicensed, $395. OX-5 Robin, licensed in June, 1936, $375. OX-5 Eaglerock, licensed, $295. J. Willard Miller, Lock Haven, Penna.

WACO 90: Tank ATC 63 motor, just majored. Ship in perfect condition. Licensed until June, 1937. $875. Aeronca C-3: Motor majored and modernized at the factory; E-113-A motor. Ship just completely rebuilt and relicensed. $1,250. AERO DIGEST, Box 2444.

WARNER TRAVEL AIR: Ship and motor good condition, $725. Velie Monocoupe, just relicensed, $1,350. Will accept crack-up on trade. Want J-5 motor. Carthage Airways, Carthage, Missouri.

FAIRCHILD: 3-place J6-5. No time on motor and ship since completely reupholstered, recovered, repainted and majored. Ship looks new. Starter, airwheels, brakes, tail wheel. Bargain at $1,500. Warner Cessna: 4-place cabin in perfect condition. Steel prop, airwheels; 20 hours since majored. Pioneer Aircraft Co., Teterboro Airport, Hasbrouck Heights, New Jersey.

CHALLENGER COMMAND-AIRE and Challenger Robin: New fabric, new upholstering, steel propellers, brakes, extra instruments, Might consider trades. Exceptional bargains for cash. Florida Skyways, Miami, Florida.

PIONEER OFFERS several repossessed used airplanes, low in price, some less than the finance contract. Buy direct from finance company. Pioneer Aviation Finance, Airport, Syracuse, New York.

IDENTIFIED VELIE M-5 Monoprep: Winter enclosures; 10 hours since complete overhaul; $325. Thomas-Morriss, recovered, in good flying shape, $125. Aristocrat fuselage; left wing (repairable), $50. Tail assembly wheel, $30. AERO DIGEST, Box 2449.

1936 STINSON RELIANT: 1934 Stinson Reliant; 1933 Stinson Reliant; two 1936 Taylor Cubs; 1929 OX Waco 10; 1932 Heath high wing. All the above ships are in excellent condition. Terms and trades. Don't write; come and look them over. Priced to sell. Neil R. McCray, Fairview, Erie County, Pennsylvania.

STINSON SM8A: Fine condition, engine overhauled. Stinson 1934, flaps, 350 hours. Taylor Cub 1936, new in May; also 1935 Cub. Jennings Bros., North Grafton, Mass.

MONOCOUPE LAMBERT 90: Black and yellow rub finish throughout; electric starter and battery, generator, landing lights, bank and turn, rate of climb, thermocouple, clock, emergency release on both doors. Same as new; just 5 weeks old. Waco Straightwing J6-5: Modernized; fuselage and tail recovered; just licensed. Gruss struts. Perfect shape. $1,100. Boulevard Airport, Roosevelt Blvd., Philadelphia, Pennsylvania.

STAR CAVALIER: Velie; new covering, 100 hrs. motor time; license expires August 1, 1937. Price $575. Travel Air J5 4000, absolutely like new, no time since recovered; motor major, air wheels, brakes, tail wheel. Irvin parachute, silk, 24 foot, good condition. Price $65. Herbert Tower, 10210 Champion Ave., Cleveland, Ohio.

WACO CABIN: On floats or wheels: American Moth; Avro-Avian; J6-7 Cessna; 1936 Taylor Cub; J-5 Eaglerock; Stinson; others. Chuck O'Connor, Municipal Airport, Westfield, Mass.

1936 STINSON: 4 months old; 5-place; leather upholstering, Hamilton controllable, lights, flares; bonded, shielded; cost $8,400; sacrifice. Single place Aeronca, good, just relicensed, $325. Two-place Aeronca, major overhauled, relicensed, perfect, $650. Kinner Lincoln very clean engine, overhauled, $725. Waco F, 125 Kinner, $1,400. J-5 Travel Air, good, $1,200. J-5 Waco, like new, special paint new, engine, starter and other extras, $1,800. Taylor Cub, 5 months old; looks new; finished yellow, black stripe, $995. Meinke-Eldred Flying Service, Willoughby, Ohio.

Classified Advertising

RATES—CLOSING DATE—PAYMENT

THERE is a minimum charge of $2.50 for classified advertising in AERO DIGEST, which permits the use of 25 words, including name and address. For more than 25 words, the cost is 10c per word. Classified copy is payable by check or money order, in advance of publication.

Initials, model numbers, street numbers, etc., count one word. For example: J. A. Jones, three words . . . or Wright J6-9, two words . . . or 717 West 23rd Street, four words.

Forms for the classified columns close on the 18th of the month preceding the date of publication.

The following sample advertisement will serve as a guide for wording and counting your own advertisements—

WACO CABIN: Like new; Continental 210 hp. engine; 135
1 2 3 4 5 6 7 8 9
hours; licensed until November, 1937. Equipment includes
10 11 12 13 14 15 16
turn and bank, compass, fuel gauges, flares, cowl, pants.
17 18 19 20 21 22 23 24 25
Sacrifice for $2,300. Write or wire James A. Smith, 2375
26 27 28 29 30 31 32 33 34 35
West Grand Street, Evansville, Indiana.
36 37 38 39 40

Forty words; this advertisement would cost $4.00.

ENGINES

PRATT-WHITNEY: Wasp C engines, any part, at prices you can afford to pay. Roy M. Hall, 401 Brickell Point, Miami, Florida.

MOTORS: Continental A-40-3, $350. Wright J6-7, $550. Cirrus Mark III, $250. Wasp B, $900. Above motors sold on monthly payment plan and all just majored. Aviation Finance Co., Hemlock, New York.

BARGAINS: Challenger motor, majored, $275. J6-9 steel propellers, just reconditioned, $45. Used J-6, J-5, Challenger cylinders, $12. Pistons, $4. Valves, $4. Entire stock bargain. Florida Skyways, Miami, Florida.

J5-9: 5 HOURS since top overhaul; fine condition; needs carburetor and manifold; bargain for cash. AERO DIGEST, Box 2447.

HISSO 180 ENGINE with radiators, cowling, mount and all parts needed to install in Travel Air. All for $100. Instruments, reconditioned small type Pioneer air speed, bank and turn, altimeter, tach, compass. R. C. Downing, Parks Air College, East St. Louis, Illinois.

FACTORY OVERHAULED J-5; No time since; 300 h.p. Hisso, original factory box, brand new. Best cash offer. Frank Mills, Essington, Penna.

LYCOMING MOTORS: Model R-680-4, 225 h.p., less than 200 hours total time. Model R-690, 215 h.p. Write for prices and details. Chicago Aviation Corp., Glenview, Illinois.

GOVERNMENT OVERHAULED: 90 h.p. OX-5 motor, $107.50. New 110 h.p. Anzani, $99. Overhauled 55 h.p. Velie M-5, $148.50. Used 55 h.p. Siemens-Halske, $124.50. Overhauled 35 h.p. Anzani, $168.50. Used 135 h.p. Caminez, $95. Karl Ort, 613 W. Poplar, York, Pennsylvania.

FOR SALE: Kinner K-5, side exhaust. 23 hours since $300 major. A-1 shape. $350. R. J. McClurg, Box 305, Morristown, New Jersey.

AERONCA 113 MOTOR: Completely majored. $250. Also 2 damaged wings for C-3. Air Transport Equipment, Inc., Garden City, New York.

WANTED TO BUY OR TRADE

WILL BUY for salvage and removal any good steel truss roof type hangar of approximately 10,000 square feet. Submit complete details. AERO DIGEST, Box 2434.

WANTED: Airplane parts and supplies. Lycoming, Wasp, Wasp Junior engines and parts; tools and shop equipment. T A C A, Tegucigalpa, Honduras, Central America.

WANTED: Aircraft engines and parts. Highest cash prices. Air-Parts, Inc., Glendale, California.

WANTED: Right wing for Taylor Cub, with aileron and struts. J. B. Chambers, Clemson, South Carolina.

WANTED TO BUY: Cracked up Standard D-25. Milton Hersberger, Put In Bay, Ohio.

WILL TRADE 1936 Packard de luxe sport coupe, like new, 10,000 miles; cost $1,285; for good two- or three-place ship, not over 175 h.p. Monocoupe preferred. Write details in first letter. C. Ritterhoff, Hotel Curtis, Mt. Vernon, Ohio.

WANTED: Electric starters and generators. Wasp and Wright engines. Horizons, gyros, Kollsman altimeters. Frank Ambrose, Inc., Municipal Airport No. 2, Jackson Heights, New York.

WANTED: Have cash for good OX-5 ship such as Waco, Travel Air, Bird. Prefer Travel Air with bolted mount. John Henry Wright, North Manchester, Indiana.

WANTED: Two- or three-place cabin ship. Prefer Monocoupe or plane similar size, performance. Must be sacrificed under $1,000, for cash. Give full particulars. J. M. Mushrush, Box 202, Knox, Pennsylvania.

WANTED: Late model Heath. Prefer licensed ship. Must be a bargain. Send photo and detailed information in first letter. Write Manly Theatre, Manly, Iowa.

WANTED FOR CASH: Airplanes, motors and parts; any condition. Want J-5 main case and crankshaft. Write description and price in first latter. Floyd Becker, Aberdeen Road, S. E., Grand Rapids, Michigan.

WANTED: Good used Beechcraft, Lockheed Orion or Vega or other single-motored high speed craft. Will consider only equipment in first class condition. Bruce Gimbel, 611 Fifth Avenue, New York, N. Y.

WANTED: Pontoons for Waco F-2, 210 Continental; or will trade F-2 for 1933 cabin Waco or Stinson on pontoons. Either must be A-1 condition. R. Horne, Hangar 9, Roosevelt Field, Mineola, New York.

CONTINENTAL 165 powered Waco C or F-2; licensed or unlicensed, used or damaged. State best cash price. Waco 10 for sale, $450. Just completely overhauled, new Fahlin prop. Licensed to 1937. Near Milwaukee. AERO DIGEST, Box 2445.

WANTED: Curtiss Challenger motor, complete, in usable condition. Write full particulars. Must be cheap. Norman Smith, Buckman Airport, R. F. D. 1, Chester, Pennsylvania.

WANTED: Challenger Robin axles, with or without wheels. Roy E. Thomas, Mason City, Iowa.

WANTED: Front exhaust Kinner motor, needing overhaul; also Kinner motor mount and cowling for long nose American Eagle. Frank Headley, Jr., Lincoln Park, New Jersey.

WANTED TO BUY: Exhaust ring for J-5 engine in good condition. Jack Westfahl, Box 627, Ogallala, Nebraska.

WANTED: Aeronca or Curtiss Jr.; will consider ship on car deal. Pay cash for bargain. Consider ship needing repairs but licenseable. Chrysler-Plymouth, Okeene, Oklahoma.

WANTED: Cessna. Consider one needing work; must be cheap for cash. For sale, cheap; long nose American Eagle OX. Edward Kersten, De Pere, Wisconsin.

WANTED IMMEDIATELY: 225 Jacobs Beechcraft. Will pay cash, or will trade Kinner Travel Air 16-K. Jacobs L3 Spartan or 1934 Taylor Cub. AERO DIGEST, Box 2446.

WANTED: Aeronca C-3. Consider 1933 to 1935 model, good condition, for cash. William Hinde, Huron, Ohio.

CASH: For your airplanes in any condition. Want J-5, J-6 motor parts, air wheels, steel propellers, etc. Write details in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

AEROPLANE PHOTOGRAPHS: British and foreign. 24c per dozen, post free. Send 8c for list of titles, specimen and booklet. Real Photographs Company, Dept. O, Cooper's Buildings, Church Street, Liverpool, 1, England.

BROTHER, CAN YOU SPARE a dime? If you can, send it to me and I'll send you my 1936 Low-Priced Aviation Material Catalog. (Canada 20c.) Karl Ort, 625 W. Poplar, York, Pa.

HILL STREAMLINE wheel pants: Complete with mounting brackets 32 x 6, also Bendix wheels, brakes, tires and tubes; excellent condition. Francis Lieber, Blue Bell, Pennsylvania.

FOR SALE: DH Moth wings and many other parts. Gipsy engine parts. 650 x 10 tires, wheels, brakes. Jesse Jones, Lancaster, Pennsylvania.

AIRPLANE PARTS: For Taylor Cub, Moth, Avian, Sikorsky S-38 and Stinson 1933 Reliant. Can sell no down payment, financing full cost to you. Aviation Finance Co., Hemlock, New York.

FOR SALE: Two Cubs, excellent, $1,000, $800. Parts for Great Lakes, Travel Air, Moth, Waco, Robin, Bird. Fleet left lower wing, complete, new, $85. Cirrus, OX-5, Gipsy parts. Many others. Write for complete list. Southern Airways, Augusta, Georgia.

AVIAN PARTS: Three wing panels, tail surfaces, engine mount, landing gear, instruments, miscellaneous. English Cirrus, overhauled. Also knockdown Mead Primary Glider. Reasonable offers. Louis Melter, Bedford Airport, Bedford, Ohio.

A-1 J-5 LICENSEABLE steel prop; Never uncrated since etched and balanced. $100. Marshall Purvis, Attorney, Hot Springs, Arkansas.

MOTOR PARTS for Lycoming, Szekely, Wright, Cirrus, Hisso, Gipsy and Kinner. Chuck O'Connor, Municipal Airport, Westfield, Mass.

WINGS FOR ALL airplanes: Try our wing exchange; trade your wrecked wings for licensed rebuilt wings. We have been in the wing-building business since 1919. N. L. Aircraft Co., Vermilion, Ohio.

STINSON TRIMOTOR T and U parts. Pilgrim parts. Reconditioned Hamilton Standard adjustable propellers, 165 h.p. and up. One set (3) minute-and-half flares with switch, $55. Wiley three-minute reconditioned flares, $20 each. Reconditioned cylinders, magnetos, carburetors; wheels, tires, tubes. J-6 parts. Gas and oil tanks. Lycoming forged pistons, $5 each. Miscellaneous parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

COMPARE MY PRICES before you buy: Stop playing sap . . . start saving money—on brand new aviation parts, clothing, equipment, helmets, instruments, tools, goggles, everything you need. 40% to 60% off list prices. Nationally known stuff. Established firm. Get my amazing bargain catalog by sending one dime (Canada 20c) which I return with your first order. Karl Ort, 627 West Poplar, York, Pennsylvania.

MISCELLANEOUS SERVICES OPPORTUNITIES, OFFICES, ETC.

FLYING CLUB invites inquiries from five conscientious young men or women, interested in learning to fly economically. Free practical classroom instruction in avigation, meteorology, aerodynamics, etc., conducted by experienced pilot member. Two dollar weekly dues strictly for purchase and maintenance of training plane. Kings Flyers, care Charles Smith, Secretary, 1030 Bergen St., Brooklyn, N. Y.

DIESEL ENGINE engineering trade journal subeditor desires to join staff of aircraft manufacturer who contemplates pioneering this new field in the United States. AERO DIGEST, Box 2433.

FLYING JOBS for all our graduates. Need more. We have the least expensive system for acquiring training and getting a real flying job or getting a profitable aviation business of your own. Commercial course only $290. Free booklet. Bennett Air Service, Box 247, Hightstown, New Jersey.

WANTED: AIRPORT LEASE. Eastern corporation now operating wants new location; have six ships, shop and office equipment enough to handle almost any port; prefer location where business can be built up. What have you? Allentown Aviation Corp., Allentown, Pennsylvania.

$300 BUYS YOU a partnership in my air-cooled 2POLB, plus necessary flying instruction. Airplane just rebuilt. Lou Jacobson, 154 East 87th Street, New York, N. Y.

KNOW AIRCRAFT: Every type. 92 pictures. Postpaid. Send one dollar to Blondin Chart Co., Box 34, Los Angeles, California.

REPAIR SERVICE: Motors overhauled; crashes repaired, allowing owner delivery, paying for same monthly. We offer you cash for your motors or crashed or licensed ships also. Aviation Finance Co., Hemlock, New York.

MECHANICS TRAINING free: Airplane mechanics training and schooling in exchange for services; must finance own living expenses. Limited offer. Give details first letter. AERO DIGEST, Box 2451.

MFG. RIGHTS ON approved 2-place low cost low-wing monoplane, for sale at sacrifice. Opportunity to enter manufacturing with little capital. AERO DIGEST, Box 2452.

THE BENNETT PLAN places new airplane in operation for you. Ideal for flying clubs or individuals wishing to start flying business. Little or no capital necessary. Write Bennett Air Service, Box 247, Hightstown, New Jersey.

HELP WANTED

TRANSPORT PILOT with airplane or $2,500 for full time services as part owner in new enterprise showing exceptional opportunity. Give full particulars first letter. AERO DIGEST, Box 2448.

PARACHUTES FOR SALE

PARACHUTES: Irving and Switlik chutes, new and used. Wanted at all times used parachutes for cash. Describe fully. Air thrillers for airports, celebrations, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

3 PARACHUTES: 2 Irving silk, 1 pongee; excellent condition. Also Standard Trainer. Send your best offer. Must be sold. Sansom, 157 Charter Oak Ave., Hartford, Conn.

DECEMBER CLOSING DATE—

NOVEMBER 18TH

POSITIONS WANTED

TRANSPORT PILOT: 800 hours, single, clean record, good references; radio telephone license. Desires connection with reliable concern or individual. Position immaterial. Donald Coffield, Wishram, Washington.

TRANSPORT PILOT: 3,000 hours, all types, 12 years' experience; 1A and 3B ratings; 380 hours Stinson T and Ford time. Best of references. Ted Sellers, Jacksonville, Illinois.

TRANSPORT PILOT: Age 27, single. 7 years' flying experience, instruction and charter. Desires connections in South. Make me an offer. Sumner A. Knight, P. O. Box 116, Becket, Massachusetts.

TRANSPORT PILOT: Licensed radio operator; has sales ability; 27 years old, flying five years. Recommendations from former employers. Will go anywhere. Charles R. Spaulding, 15 Gates Avenue, Hudson, Massachusetts.

LICENSED A & E MECHANIC: Private pilot; desires position individual or company, maintenance and flying. 7 years Army, airline and commercial experience. Age 28, married. References. AERO DIGEST, Box 2437.

TRANSPORT PILOT: To fly private. If age and experience mean anything, and you want competent, reliable pilot, thoroughly familiar every state east of Mississippi, write Capt. L. Marden, Campton, New Hampshire.

TRANSPORT PILOT: 9600 hours. Experienced all types, weights; all phases commercial aviation. Just completed blind flying course. Excellent references. Go anywhere. Now employed. AERO DIGEST, Box 2441.

YOUNG MAN: Would like work as apprentice mechanic. Has considerable mechanical experience. Will consider anything, go anywhere. Will give references. Paul F. Stibbard, Box 2457, Timmins, Ontario.

WORK WANTED by A & E mechanic. 17 months experience in approved repair station. 6 months as manager of repair shop. Excellent references. Don't drink; single; age 22. George C. Sagaser, Lake Region Flying Service, Devils Lake, North Dakota.

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This month marks the delivery of Pratt & Whitney's 1000th two-row radial engine . . . destined for service with the U. S. Army Air Corps to power the latest high-performance Seversky Pursuit.

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UNITED AIRCRAFT CORPORATION
EAST HARTFORD, CONNECTICUT

AERO DIGEST

INCLUDING AVIATION ENGINEERING

ECEMBER 1936

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35 CENT

The close of 1936 finds our air forces reaching new standards of performance. Here are three of the year's pace-setting ships . . . all by Curtiss . . . all powered by Pratt & Whitney.

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EAST HARTFORD CONNECTICUT
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UNITED AIRCRAFT CORPORATION

Published monthly by Aeronautical Digest Publishing Corp., at 515 Madison Ave., New York, N. Y. Yearly subscriptions, $3. Entered as second class matter July 17, 1922, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Additional entry at the Post Office, Philadelphia, Pa.

WE SPENT $200 ON THIS AD*

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America's Foremost School of Aeronautics

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Instrument with Rim Light Adapter

Equipped with snap connectors and built-in resistors

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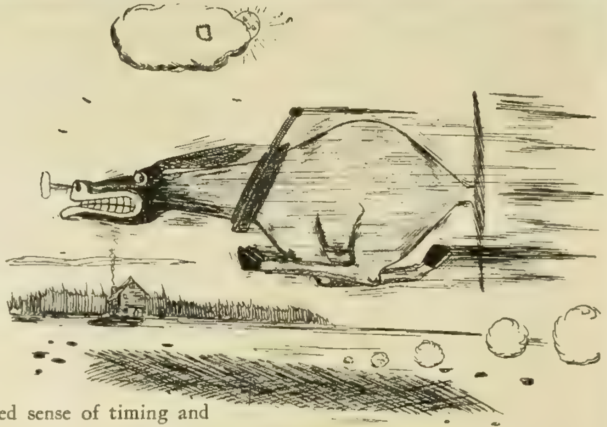
5 JUNIUS STREET, BROOKLYN, NEW YORK
WESTERN BRANCH—1224 Airway, Glendale, California • EUROPEAN DIRECTOR—
Commdr. M. Calderara, 47, Avenue Brimont, Chatou (S & O), France

The Birdmen's Perch

Chef! A fat cake and one candle, please. The Perch becomes one year old with this issue, and we think it's time to celebrate. For our fan mail makes us think that the page is pretty popular. So, for Pete's sake, don't fall down on us. Keep on firing us the news and dirt and whoppers that make the sheet interesting. Address your mail to

MAJOR AL WILLIAMS, *Manager, Aviation Department*,
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.



Drawn by E. A. Camburn

IF SHE WERE YOURS . . .

"This Christmas Nancy Birnbaum, eight, will race downstairs to her Christmas tree like any other healthy, excited child.

"But just a little over a year ago, Nancy was lying gravely ill in New Rochelle Hospital (N.Y.). She was fighting valiantly against a streptococcus infection in her left leg, complicated by thrombophlebitis, a blood clot which had formed in one of the leg veins and interfered with normal blood circulation. A rare, recently-discovered serum was needed to help her weakened system combat the infection.

"This serum was so scarce that it was then stored in only two cities in the country. There was some in Milwaukee.

"The serum was rushed by plane from Milwaukee to Chicago. From there a plane flew it to Newark. From Newark it was rushed to the desperately ill little girl in the hospital at New Rochelle.

"It arrived in time. Nancy quickly responded to treatment and eight days later she left the hospital for her home.

"Nancy's is but a single instance out of many. All over the world, day after day, airplanes with their blessing of speed are performing missions of mercy for countless people." —W. S.

JUST A LOT OF PICCOLO PLAYERS?

"A great majority of pilots play some musical instrument. Birdmen have such a finely developed sense of timing and rhythm that it's a cinch for them to learn to play a piano or toot a horn." —K. B.

DE LUXE AIN'T THE WORD FOR IT

"Complaints have reached us that one of the world's most commodious airliners has a couple of berths that are a trifle tight and absolutely no facilities for broiling steak.

"That's awful. We're going to put our foot down and refuse to set sail in a transport until somebody designs one that contains a sidewalk cafe, a swimming pool and a three-chair barber shop.

"Also, we want breakfast in our bed on Sunday morning." —E. D.

LILY-LIVERED

"At an air meet this summer, the pilot who was to take the parachute jumper aloft suggested that said jumper ride on the wing. But the young fellow had his own ideas. 'Not by a damsite,' he yelled. 'I won't ride on the wing. Why I might fall off!' " —R. M.

THIS MONTH'S WHOPPER

James McDonald Henry O'Toole
Owned Stubborn Sam, one lazy mule.

To start that mule he'd try in vain,
But every time 'twas just the same—

Until one day a Gent came by
And said, "I'll give that mule a try."

He jumped the fence; went to his van
And soon came back with a small red can.

He opened Sam's mouth and poured some
in.
And what Sam did was a doggoned sin!

He wound his tail like a Rotary Gnome,
And took right off for parts unknown.

Says Farmer James to the Miracle Man,
"What in the world is in that can?"

" 'Tis Good Gulf Aviation Gas," says he,
And held up the can for the farmer to see.

"Well give me a swig of that same good
gas,
'Cause I've got to catch that blasted Ass."

—E. A. (Slim) Camburn

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF

GULF AVIATION PRODUCTS

PARKS AIR COLLEGE, THE TRAINING DIVISION OF COMMERCIAL AVIATION

(Above) Faculty and students of Parks Air College assembled October 12, 1936 to hear the first of a series of lectures delivered by prominent executives.

(Below) During a training flight in a J-5 Travelair a Parks Professional Flight student explores cloudland.

(Lower) The twin-engined Monocoach, with landing gear lowered, is ready to set down on Parks Airport. The Monocoach is the latest addition to the Parks training fleet of thirteen planes. It is for the use of the Professional Flight student in advance training. In the background is the South Hangar where the training fleet is housed.

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The purpose of Parks Air College is to meet the demand for training that prepares for leadership in the four fields of commercial aviation.

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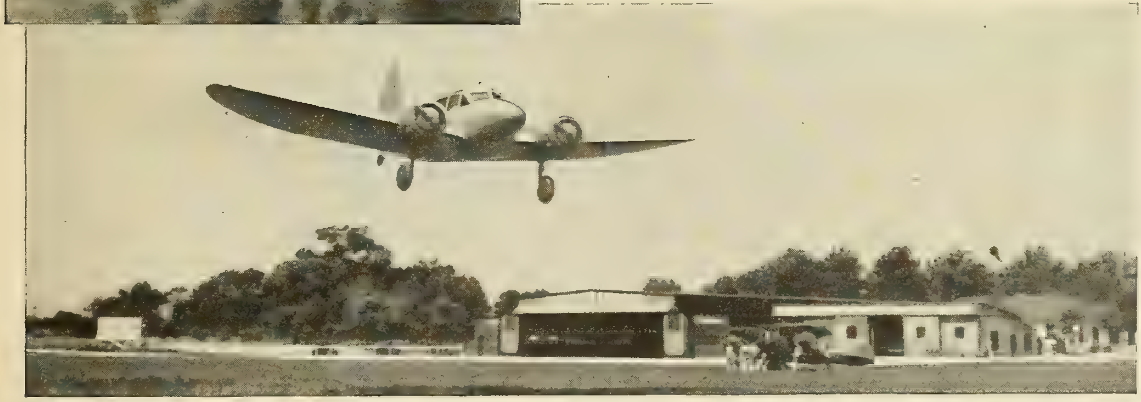

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Photo shows T. Claude Ryan, joined by a group of flight students, extending congratulations to a student pilot who has just won his precision medal.

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T. Claude Ryan

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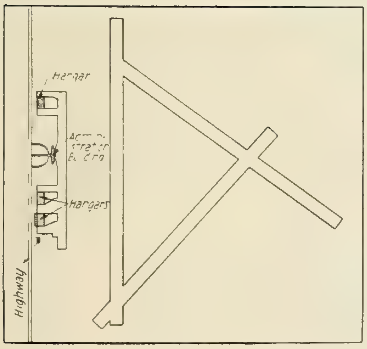

Wold-Chamberlain Airport, Minneapolis, showing plan of concrete runways. Runways 150 ft. wide and 3,000, 3,000 and 3,500 ft. long, with 6-in. slab cast in 20-ft. strips thickened to 9 in. at edges. WPA project under sponsorship and direction of Board of Park Commissioners, Minneapolis. C. A. Bossen, Supt., A. E. Berthe, Park Engineer.

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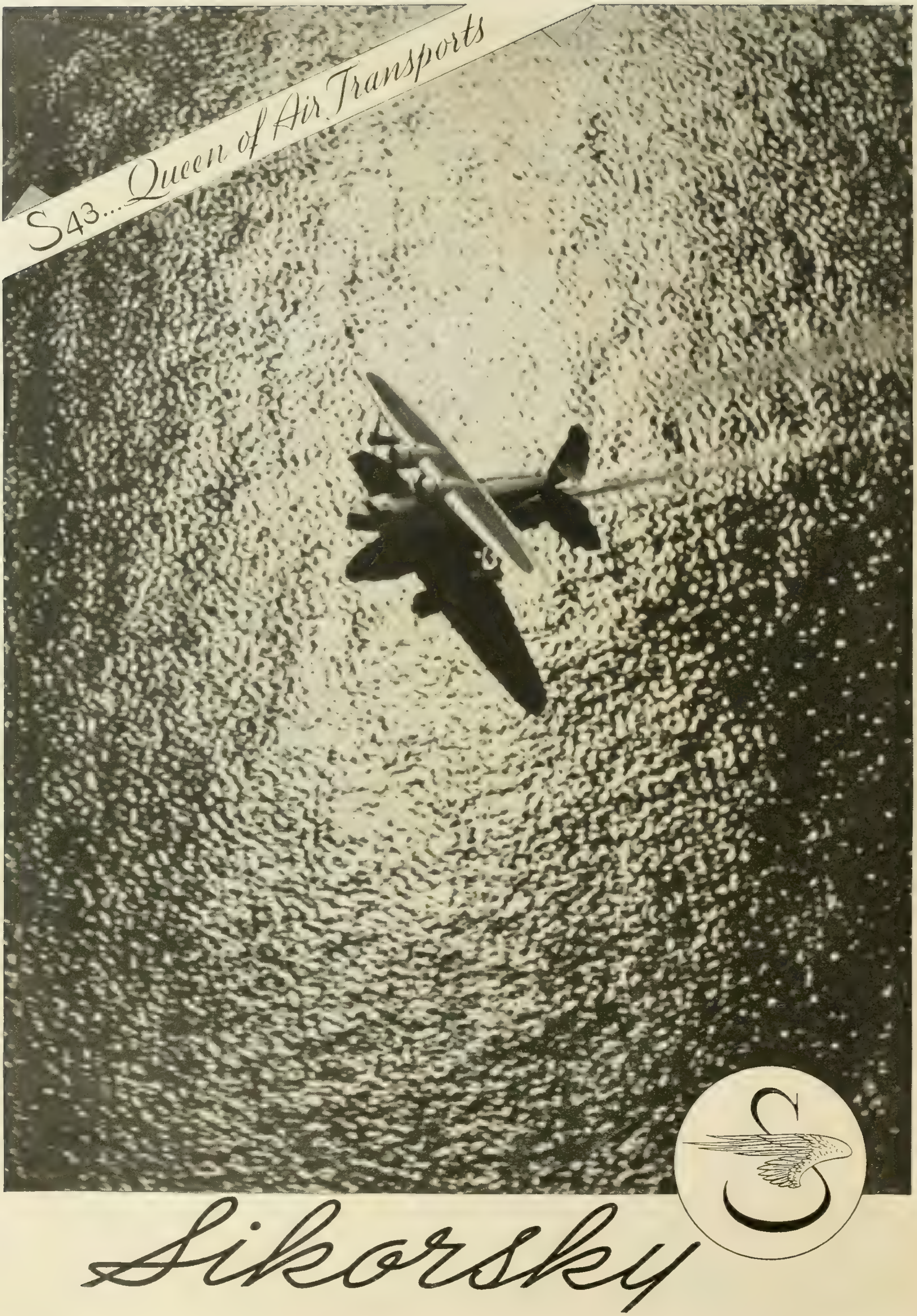
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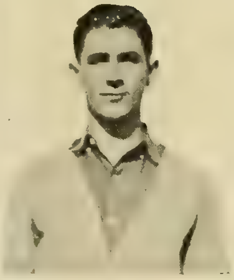

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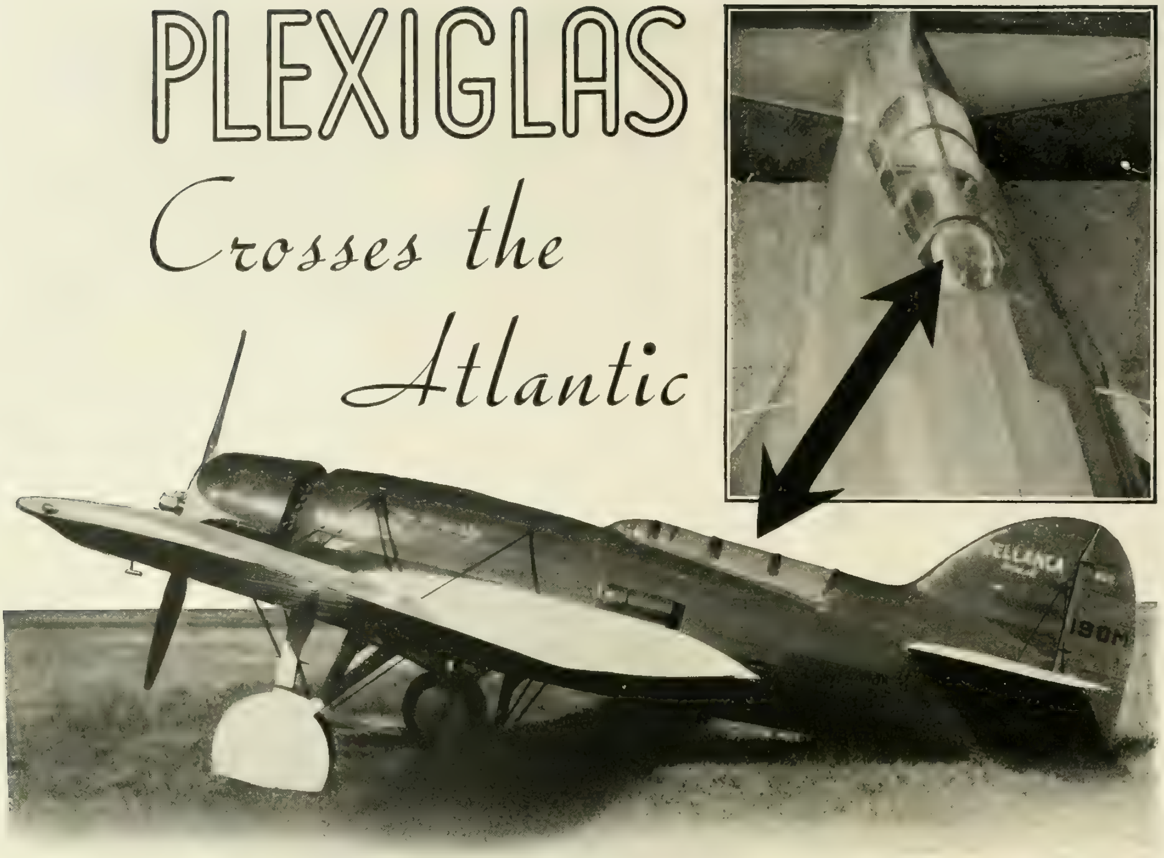
Crosses the Atlantic



Plexiglas was used exclusively in the cockpit hood cover of this Bellanca Model 28-70 "Flash," which recently set a new record for an eastern crossing of the Atlantic Ocean. Plexiglas was chosen for this cockpit cover due to its strength, remarkable transparency, resistance to weathering and ability to be shaped into two- and three-dimensional curves conforming exactly with the curvature of the streamlined body of the plane.

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Published monthly by the Aeronautical Digest Publishing Corp., 515 Madison Avenue, New York, N. Y. Phone Plaza 3-6969. Cable address: AERODIG. Single copy, 35c. Subscription price, $3 per year; Canada, $4.25; other countries, $5.

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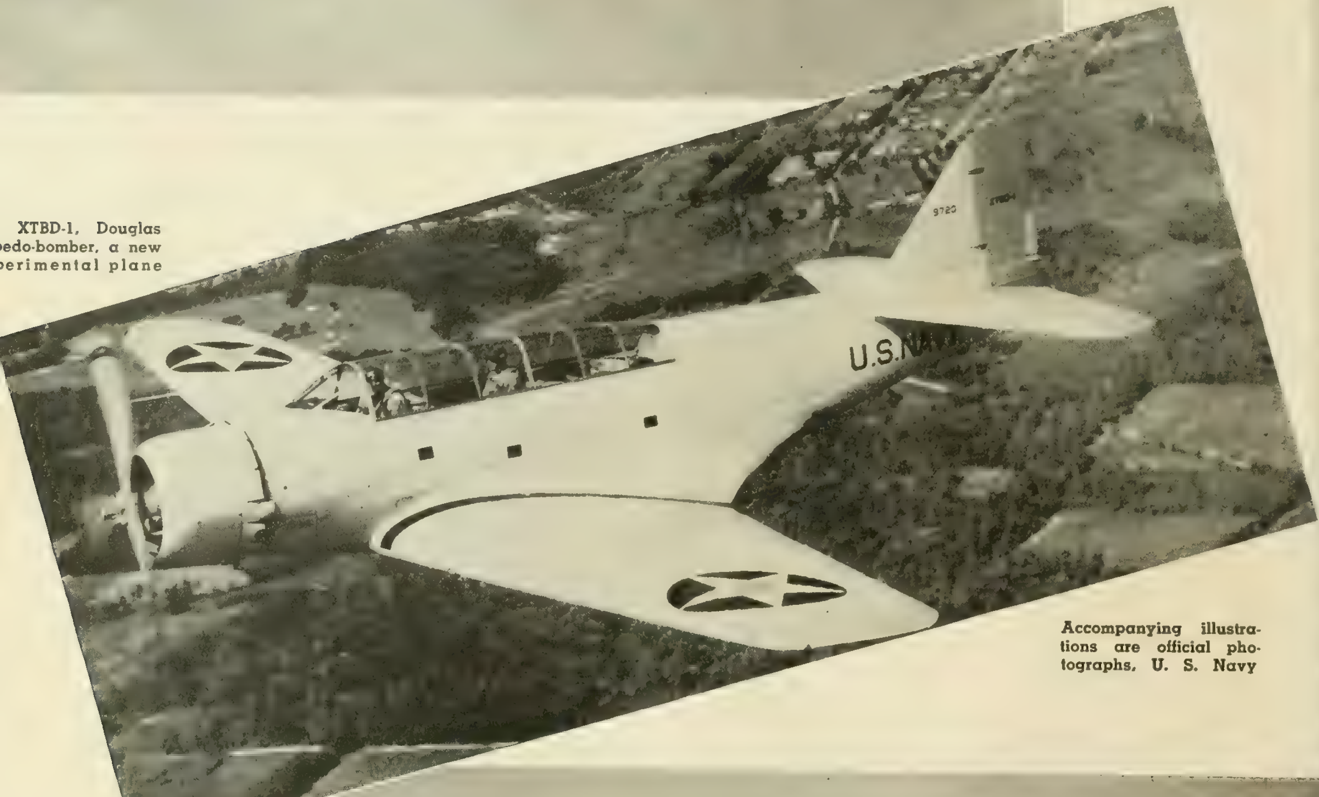
One of the Grumman F2F-1 Single Seater Fighters from the Aircraft Carrier U. S. S. Ranger



XTBD-1, Douglas pedo-bomber, a new perimental plane

Accompanying illustrations are official photographs, U. S. Navy

Latest patrol bomber, the Consolidated PBY-1, holder of two international distance records

AVIATION ACTIVITIES OF THE UNITED STATES NAVY

REAR ADMIRAL A. B. COOK, U.S.N.

● During the fiscal year 1936, United States Naval Aviation maintained its foremost position among world powers by operating 977 first-line planes, of which 483 participated in annual maneuvers off the west coast of Central America last April and May.

Funds provided for experimental purposes have been used to obtain a marked improvement in airplanes and engines and the best possible improvement in instruments, radio, armament, materials, aerodynamics, carrier launching and arresting gear and seaplane launching and recovery gear. Competition has been fostered in the industry in bringing out advanced experimental models of aircraft and at this time the Bureau has available for procurement in quantity one or more models in each class with improved performance.

In the matter of new and replacement aircraft the Bureau has used funds provided to procure aircraft of approved types, and in accordance with approved complements which embody the latest and most important developments in aeronautics. Increased engine powers available and improved aerodynamic design have contributed to the marked increase in speed range of new service types. This has been most evident in new scout-bomber airplanes and patrol planes now under procurement.

Important accomplishments during the fiscal year 1936 include: (a) provision of experimental aircraft and engines of decidedly improved performance in connection with the conduct of the experimental development program of aircraft, engines and accessories, and of the research activities connected therewith; (b) procurement of new service aircraft of outstanding performance in accordance with the requirements of the Naval Aeronautic Organization; (c) flight of the XP3Y-1 from Norfolk, Va., to Coco Solo, Canal Zone and non-stop from Coco Solo to San Francisco, the latter flight establishing two new international distance records for seaplanes, namely airline distance record of 3281.402 statute miles (previous record 2462.166 statute miles) and a broken line distance record of 3443.25 statute miles (previous record 2764.848 statute miles); (d) initiation of training of cadets to meet the shortage of naval aviators.

(e) Expansion of Naval Aircraft Factory for the manufacture of aircraft and aircraft engines in accordance with the Vinson-Trammell Act; (f) transfer of Rockwell Field, San Diego; Luke Field, Pearl Harbor and Old Bolling Field, Anacostia, D. C., from the custody of the War Department to the Navy Department and of the Naval Air Station, Sunnyvale, Calif., from the Navy Department to the War Department.

(g) Establishment of an aviation field at St. Thomas, V. I., by Marine Corps Aviation; (h) authorization for acquisition of site and for construction of a Naval Air Station at Alameda, Calif.; (i) expansion and modernization of the Naval Air Station, Pensacola by replacement of old facilities and provision of new facilities to provide for the increased training program.

(j) Launching of U. S. S. *Yorktown;* (k) delivery of 370 airplanes and 468 engines incorporating advanced performance; (l) overhaul of 544 airplanes and 1135 engines at naval aviation bases, an increase of 12% in overhauled aircraft and 45% in overhauled engines as compared with the fiscal year 1935; (m) increase in number of flying hours between routine overhauls for both airplanes and engines as a result of improved operating maintenance, better design features and improved quality of overhaul work.

(n) Selection of 44 officers for Aeronautical Engineering Duty Only.

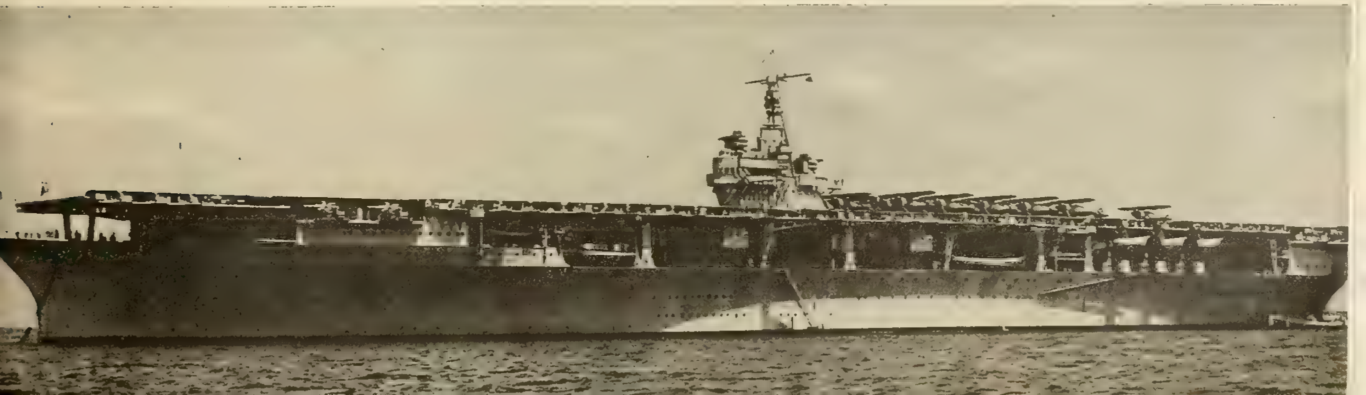
Ship-based aircraft in the Fleet participated in all Fleet problems and tactical exercises during the fiscal year 1936. Participation of the patrol squadrons in these problems and exercises included a flight by the San Diego based patrol squadrons from San Diego to Coco Solo and return.

The policy of ferrying new aircraft to the West Coast for delivery and ferrying some old aircraft to East Coast stations for overhaul and return was continued, and during this fiscal year involved a total of 492 transcontinental flights.

Increased attention has been devoted by operating units to problems involved in instrument flying. The Bureau has purchased and delivered to operating activities 11 Link instrument and radio beam trainers, which were expected to provide a method of ground training which will greatly reduce the time required for instruction in the air and will result in the continuation of progress already made in this phase of flying.

Training of Naval aviation cadets at Pensacola, as authorized by the Aviation Cadet Bill, has progressed satisfactorily. The first of these cadets will commence duty with the fleet during the fiscal year 1937. Considerable interest is attached

The Aircraft carrier U.S.S. "Ranger"



to this expedient for making up for the shortage of regular officers available for aviation duty.

Lighter-than-air activities were concentrated at the Naval Air Station, Lakehurst, where four non-rigid airships were in operation for training and experimental purposes. In addition, the U. S. S. *Los Angeles* was used in a non-flight status in a program of mooring and handling tests.

Annual 14-day periods of training duty were conducted for all members of the Aviation Fleet Reserve during the fiscal year 1935. The large number of Fleet Reserve aviators on extended active duty for the purpose of augmenting the complement of regular Naval aviators in connection with the training of aviation cadets at the Naval Air Station, Pensacola, made it possible to provide these training periods for a considerable number of the volunteer aviation reserve officers who previously had been deprived of this training due to lack of funds. This training served not only to stimulate the interest of the volunteer group, but also provided badly needed refresher courses. Inspection of the various Reserve aviation activities revealed that required syllabus flying had been well carried out and that all activities were efficient in the execution of their assigned missions. On July 1, 1936, a new Reserve base was established at Kansas City, Kansas.

During the fiscal year 1936, the Bureau was able to provide the additional machine equipment necessary to permit each independent activity to conduct major overhaul of aircraft and engines. The value of the training afforded Reserve personnel incident to conducting major overhaul cannot be over-estimated.

Five new JF-3 amphibion airplanes were delivered during the year. These airplanes are used as guard planes where the various Reserve aviation squadrons perform gunnery exercises over water and in emergency for humanitarian purposes.

During the fiscal year, 494 students successfully competed for aviation cadet appointments and were ordered to Pensacola for flight training. It is expected that approximately 70% of this number will qualify and be ordered to fleet units during the fiscal year 1937.

Cruiser Aircraft Wing in formation

Twenty-three Reserve aviation students successfully completed the flight course at Pensacola during the year and were ordered to active duty with the Fleet; six students were commissioned second lieutenants in the Marine Corps Reserve, designated as naval aviators, and assigned to active duty with regular Marine Corps squadrons.

Thirty-one candidates were assigned to elimination flight training at Reserve bases, of which number 3 failed in elimination, 2 failed to accept appointment, and 26 were appointed Aviation cadets in the Marine Corps Reserve and assigned to active training duty at Pensacola.

All Marine Corps Reserve squadrons were assigned to two weeks' active duty at the Reserve bases to which attached, and 62 officers and 380 enlisted men participated.

SOC-1 Curtiss scout-observation plane

In cooperation with the Bureau of Engineering, and the Naval Research Laboratory, the old investigation of the value of static direction finding was reorganized and placed in active operation. Arrangements were made for an intensive study of this problem during the fiscal year 1937. The Bureau of Aeronautics, Bureau of Engineering and the Bureau of Standards started the development of a radio-meteorograph.

Upon the recommendation of the Commander-in-Chief, U. S. Fleet, the Bureau furnished pilot balloon equipment to all battleships and cruisers to permit obtaining upper wind data when not in company with vessels having aerological units. Forty-one sets of equipment were so furnished. The policy of having all new aerological instruments tested at the Bureau of Standards was continued.

Training activities in the Naval School of Photography at the Naval Air Station, Pensacola, were greatly increased during the fiscal year to supply trained men to fill the increased photographic complement authorized for the Navy as a whole. Four Naval officers, 28 enlisted men, (Navy), and 3 enlisted men, (Marine Corps), were graduated during this period.

Fleet gunnery exercises were photographed as requested by the Division of Fleet Training. Photographic services, including the making of aerial and ground photographs and motion pictures were furnished to the Fleet, shore stations and various governmental departments.

Experimental photographic work and testing of new photographic equipment has been conducted at the Naval Air Station, Anacostia, D. C. A combination mapping and oblique aerial camera, which is fully automatic in operation and is time recording, has been developed and delivered to the Service, and reports indicate it to be satisfactory for the dual purposes for which designed. This camera will replace the present large single lens mapping camera, and the short focus

SOC-1s operating off Central America

oblique camera. A portable photographic flight laboratory has been developed for quick negative finishing and printing while in flight. Eight of these laboratories have been shipped to various units.

Airship development, especially as regards large sized units, has been largely in a suspended status awaiting formulation of attitude towards procurement of additional large airships for Naval purposes.

The special committee on airships of the Science Advisory Board, appointed at request of the Secretary, made report in January, 1936, containing its recommendations as to policy, which recommendations were favorable to a continuing program of airship construction.

In May, 1936, the Chief of Bureau made recommendations to the Secretary with reference to the Naval airship situation, and in keeping with the Durand Committee's Report, briefly as follows:

Non-rigid Airships: build the two airships for which funds were included in 1937 estimates.

Moderate Sized Rigid Airships: obtain funds and begin immediately construction of an airship of about 2,500,000 cu. ft., as recommended by the General Board in 1934.

Experimentation and Advancement of the Art: obtain funds and begin immediately construction of a metal-hulled airship of about 1,500,000 cu. ft.

Large Rigid Airships: include large airships in the Department's program for airship development, but that ways and means for acquiring large airships be not fixed at this time, pending a clarification of activities in the commercial airship field, in which activities the Department should cooperate wherever practicable.

The following amounts were made available for obligation during the fiscal year 1936 under "Aviation, Navy": navigational, photographic, aerological and radio equipment, $498,200; maintenance and operation, aircraft and air stations, $11,020,450; experiments and development, $2,498,000; aircraft construction, $24,805,660; total "Aviation, Navy," $38,822,310; number of operating aircraft, 958.

Funds for "maintenance and operation of aircraft and air stations" were not proportionate to the increase in number of operating airplanes and added burdens to air station facilities. The situation was partially relieved through work done by employees of the WPA, but it is anticipated that funds must soon be appropriated directly under the appropriation out of which these stations are normally sustained.

The appropriation for the fiscal year 1936 authorized procurement of the second increment of airplanes in the program to provide a naval aeronautic force in number commensurate with a Treaty Navy. This authorization will supply the *Yorktown* and *Enterprise* and six new cruisers *(Quincy, Vincennes, Brooklyn, Philadelphia, Savannah* and *Nashville)* with aircraft.

A marked increase in the cost of experimental airplanes has been noted. This factor together with constant improvement and new developments in all branches of the aeronautical field merits a substantial increase in funds for this purpose.

The following construction work was assigned to the Naval Aircraft Factory in accordance with the Treaty Navy Act which specifies that not less than ten percent of the airplanes and engines procured by the Navy be manufactured in a Government plant: 1 experimental training plane; 85 service type training planes; 1 12-cylinder engine; 100 engines for training planes; and design of a high speed engine, a two-cycle V-type engine and a compression ignition engine.

Funds available for "maintenance, aviation" for the fiscal year 1936 proved to be inadequate to meet the demands placed upon this part of the appropriation. As a result, the stock of basic materials used for aircraft overhaul became depleted, and shortages of material existed at several stations. Action to correct this deficiency has been taken from funds made available in the 1937 appropriation.

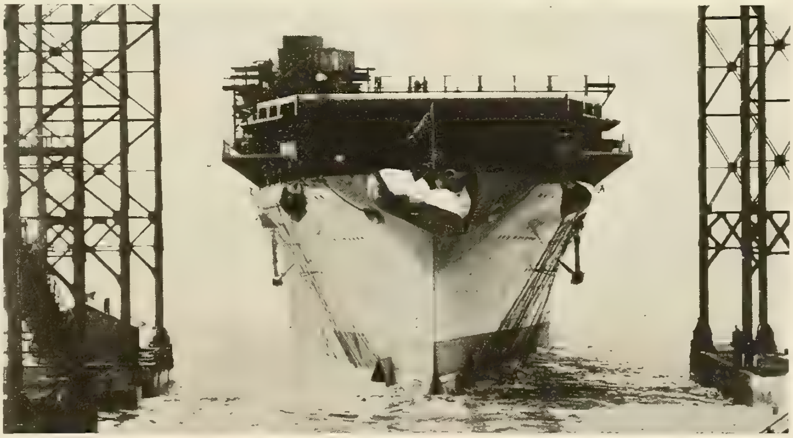
The 1936 Maintenance Tour of Inspection of the leading Army, Navy and commercial bases was participated in by representatives of the Bureau and all overhaul bases. Following the tour, phases of the overhaul and supply situation were discussed and recommendations for the coming year made. The tour disclosed that the aircraft repair facilities at all overhaul bases are now operating under congested conditions and that without exception the overhaul requirements for naval aviation have outgrown available facilities.

Similar congestion exists at the San Diego Air Station, with regard to storage facilities for fleet aircraft and supplies.

A study of conditions as they now exist, together with the anticipated future expansion, indicates that night shifts may in the future be necessary to meet the overhaul load at the several stations.

The policy of supplying the service with engines of maximum performance,

Aircraft carrier U.S.S. "Enterprise"



N3N-1 training plane built at the Naval Aircraft Factory

reliability and endurance has been maintained by the continuous development and improvement of advanced types of engines together with an uninterrupted program of proof testing. The latter includes not only laboratory tests, but also standardized flight service tests in new airplane types, supplemented by the necessary special tests required to cover the requirements of Naval aviation. As a result of this policy and based on the results of the test program and of developments in the experimental field, it has been possible to provide a growing list of improvements to service equipment. The two-row radial engine has continued its service history with marked success. Late models of all current service type engines have shown increases in power output and altitude ratings without increase in displacement. Crankshaft torsional vibration dampers and full pressure lubrication to cylinder valve gear now standard in recent service types, have been so satisfactory that similar equipment is being supplied to certain earlier engine types where mechanical characteristics and economical considerations warrant such action.

Similar development and test programs are in progress on accessory devices to meet the increasing complexities of modern power plant installations, particularly as regards automatic regulation, for the purpose of minimizing the demands upon the pilot's attention made by the power plant while in flight. The entrance of additional manufacturers into the accessory field and the improvement of present standard type devices have been among the recent developments. Improvement in equipment and methods for starting under cold or wet weather conditions has continued to be actively pressed. In the propeller field the service applications of automatic constant speed propellers has been an important advance. Aircraft engine fuels and lubricants, one of the critical foundations upon which engine improvement is built, has been continued as the subject of an extensive development program.

The Naval Aircraft Factory, in Philadelphia, is the main supply depot and test station for Naval aviation. Insofar as has been practicable the testing facilities have been expanded to take care of the increasing demand. Improved equipment has been purchased for both the aeronautical engine laboratory and the physical testing laboratory.

An order for 85 training airplanes based on the experimental XN3N-1 has been placed. The XN3N-1 was built at the factory and tested at Anacostia and Pensacola, during the past year. Deliveries of the production airplanes commenced in June, 1936.

Progress has been made in establishing the aircraft engine manufacturing plant at the factory. Buildings have been completed and machine tools assembled. Development and design work, including tooling, for the production of aircraft engines is proceeding.

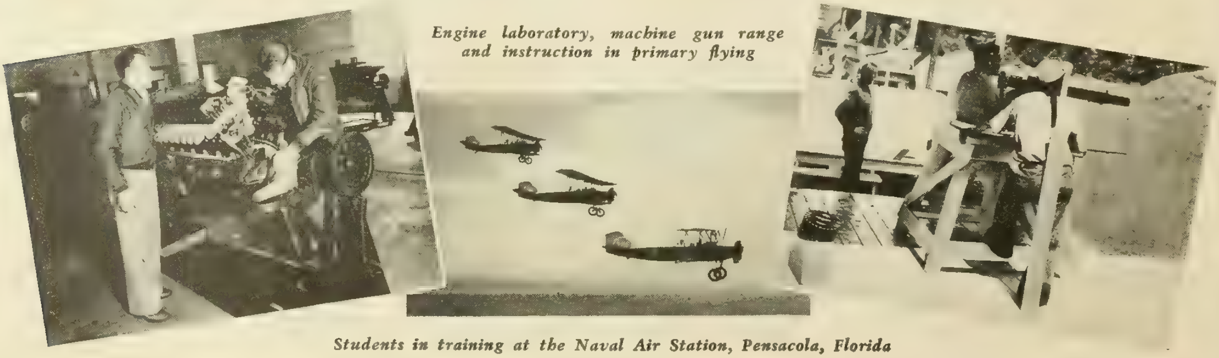
Orders have been placed and manufacture has been started on aircraft built by the Government in accordance with the law requiring that at least 10% of the airplanes and engines being procured be built by the Government. On account of the necessity to prepare an engine manufacturing plant for the engines, the actual completion of engines has not yet been effectively carried out.

Instructions initiated in 1934 with respect to the procurement of aircraft have been continued in effect. Although this was a major departure from the procedures which had been followed theretofore, efforts have been expended to avoid interference with the normal delivery of aircraft to service. Procurement has been continued uninterrupted and the competitive basis for aeronautical material has been expanded. Design competitions, flight competitions, and competitions in purchase are stressed in the procurement of aircraft and aircraft engines.

During the year 370 airplanes and 468 engines were delivered. This delivery is considered to be a creditable performance.

The Vinson-Trammell Treaty Navy Bill authorizes the procurement of Naval aircraft in numbers commensurate with the strength of the Navy in surface ships. A tentative program of aircraft con-

(*Continued on page 75*)



Engine laboratory, machine gun range and instruction in primary flying

Students in training at the Naval Air Station, Pensacola, Florida

EDITORIALS

"Research is nothing but looking forward to see in which direction industry may or may not go. In doing research work, in which you are trying to accomplish something that has never yet been done, there is no possible way to forecast how much it is going to cost, when it is going to be done, or how much it is going to be worth, if and when it is finished. So, you will have to take those things on faith. And faith and patience are the two fundamentals upon which all research organizations are built."—CHARLES F. KETTERING, General Motors Corp.

Let's Have A House Cleaning

● Rumors were rampant a couple of months ago that Messrs. Vidal and Martin, (and maybe Col. Cone) had handed in their resignations. But that was just before the people had gone to the polls, and Jim Farley thought it would be wise if nothing was said about that. He didn't want the voting public to know that Roosevelt appointed to office men hardly qualified to do a successful job—as proven by the fact that the Copeland Committee found that the officials of the Bureau of Air Commerce were not suited for the positions they held and it would be best for all concerned if they were removed from office. And that's putting it mildly.

We are interested in having an efficient-working Bureau that commands the respect, rather than the contempt, of the industry it controls—and what is more important, a Bureau guided by men who know what they are doing. And that includes John Geisse, chief of the Bureau's development section, who now appears to have a new slant on the lamented $700 airplane idea.

It seems, from what Mr. Geisse says, that the Bureau didn't mean what it said about a $700 airplane; what it really meant was that even if the plane cost $2000, the government would stand the difference and the selling price would be $700. On the same basis, the government might just as well assume a magnanimous attitude and give planes away. Geisse would like people to forget that a $700 price was ever mentioned in connection with the Department's notorious blunder. A contemporary magazine, Feb. 1934, quotes Vidal with the following—"The price may not be exactly $700, but the plane can hardly be expected to meet with success if it is very much more than that." And in a Dept. of Commerce release (Nov. 8, 1933) Vidal is quoted: "I am convinced that there are men and women who are airplane pilots but do not own airplanes, who would want to purchase aircraft if the initial price and cost of operation and maintenance were within their means. On the other hand, if the manufacturer knew he would have a large market for a certain type craft he would eagerly undertake production in volume which would enable him to sell his product for a price around $700 *or even lower.*" (The italics are ours).

This is a fair example of the consistency of the Bureau and of the "harmonious" co-operation between the Director and his underlings. No wonder Senator Copeland stormed all over the place when he returned from a trip to find that nothing had been done about his committee's recommendations.

Surely the President doesn't want to have the same difficulties with the aviation industry for another four years. There are too many other things that will be occupying his time—primarily getting the country back on its feet.

Re-Armament In The Air

● Simultaneously with the War Department's announcement that 1936-37 funds for the purchase of Army planes were exhausted, came reports from abroad that more money than ever before was to go into the various air forces of Europe.

The picture is not as bleak for us as it might seem. We are still getting the finest military planes in the world, and indications are that another 700 planes will be added to the Army Air Corps next year under the 5-year plan to build up an air fleet of 2300 units. The Navy has in active service 977 first-line modern planes and after reading Admiral Cook's article in this issue of AERO DIGEST, one cannot but be convinced that this branch of the service is maintaining the finest traditions of the United States Fleet.

Italy, France, Germany and Great Britain are turning out warcraft by the thousands. Production has assumed proportions even greater than that during the hectic closing days of the world war. The necessity for speed in production is so profound that England is turning to her dominions—particularly Canada—to help her re-arm in the air.

As this goes on, the United States finds itself being pushed further back in a comparison with other world powers. Once we were first—in quantity and quality. Now we are fifth or sixth in quantity and our claims of leadership in quality are seriously threatened.

Only sufficient appropriations by Congress for new planes and equipment, plus a more intelligent governmental interpretation of and an earnest attempt to cater to the industry's needs will enable us to climb back to a proper position in world aviation.

Looking Ahead To 1937

● At the beginning of the year aeronautical factories were working overtime attempting to catch up with orders and airline traffic was at its greatest peak. As the year comes to a close we find that the hopes of 1936 have more than materialized.

Production of aircraft and aircraft engines, spare parts and accessories continues to climb steadily. Most factories are still working on three 8-hour shifts daily and greater expansion programs than ever before are in the process of completion for 1937.

Hope in 1935 turned to fact in 1936. Orders for military aircraft mounted as commercial and private deliveries skyrocketed. Air transport traffic outgrew the airliners and larger, faster and more comfortable planes had to be designed and constructed. Schools were harassed and embarrassed—they couldn't turn out technically-trained aeronautical men fast enough to meet the demands. Many graduates were offered positions even before diplomas were handed out. Exports jumped far above expectations, and license agreements with foreign countries also worked to the advantage of the American aircraft manufacturer.

Research in the field of acoustics has been responsible for the design of airliner cabins in which the noise level has been lowered to a marked degree. Heating and ventilation problems have also been dealt with successfully in the modern transport which will be larger, faster and more comfortable.

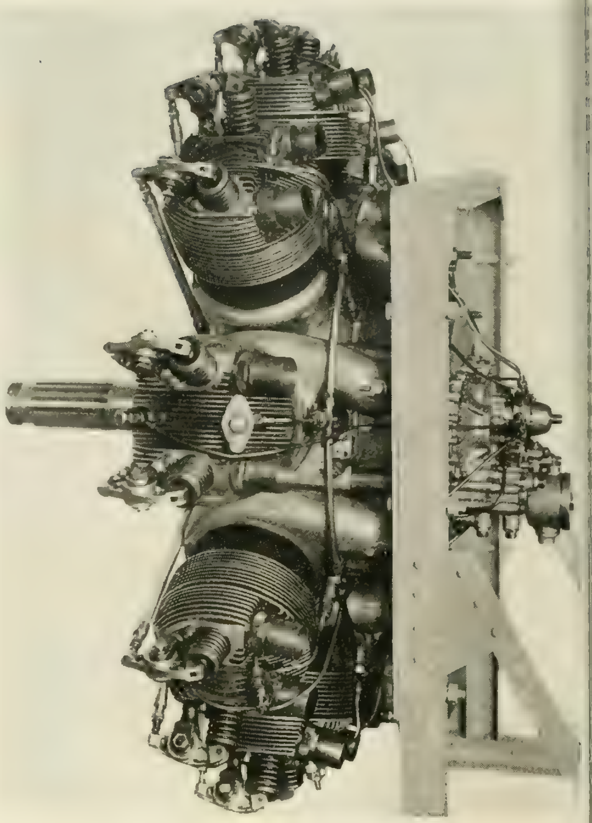
Engines developing 1000 to 1200 horsepower are being installed in new military planes as well as the transports. Research and development continues on Diesel engines for aircraft and on larger horsepower in-line, Vee and H-types for military utilization. For transocean airlines, larger flying boats are being constructed, based on the operating knowledge gained from Pan American Airways' successful operations across the Pacific.

The year 1937 will witness the continued steady growth of the industry—not overnight mushroom growth such as we saw in 1929, but solid thoughtful expansion made necessary by the demands outside the industry. The customer who pays the bills has a pretty good idea of what he wants and it's up to us to supply it.

Some Advantages of the Two-Stroke Cycle Diesel Engine

●

GLENN D. ANGLE



Successful type 2-stroke cycle Diesel engine, model ZV 240 A, manufactured in Czechoslovakia

● The four-cycle principle of operation has been employed by the majority of Diesel engines constructed for use in aircraft, yet there is much to support the opinion that the 2-stroke cycle deserves more consideration for engines of this class. In reference to its adaptation to aircraft, the 2-cycle engine offers an opportunity to secure reasonably low specific weight, thereby minimizing one of the inherent objections to the compression-ignition type. This improvement has been effected in engines of this category built for various industrial purposes, and similar weight decreases might be duplicated in special forms without much difficulty.

As for operation, the compression-ignition engine utilizing solid injection can exploit the 2-cycle principle better than the mixture-fed engine can use it. Scavenged by pure air, the Diesel is not handicapped by fuel losses through the exhaust valve like the 2-cycle engine which draws in a fuel-air mixture from a carburetor.

A Low-Speed Engine

Furthermore, the practical limits of rotative speeds fairly well coincide among both types. The Diesel is fundamentally a low-speed engine in the sense that, as we depart from the constant-pressure cycle and approach the constant volume cycle by earlier injection of fuel to secure satisfactory output at higher rotative speeds, the penalty is a higher ratio of maximum to mean cylinder pressures which, in turn, demands more rugged construction and, therefore, greater weight.

Heat dissipation and volumetric efficiency problems (due to the shorter time allowed for scavenging and filling) seem to place definite restrictions on the bmep developed as compared with the engine which operates on the 4-stroke cycle, but twice as many firing impulses occur at a given speed. Therefore the output from an engine of any size or weight should be considerably higher, with only a slight loss in thermal efficiency.

Returning to the question of speed, the 2-cycle engine, whose maximum speed is usually restricted by considerations of its valve operating mechanism, must operate somewhere near the speeds found most desirable for solid injection of heavy fuels. These engine speeds are by no means unsatisfactory for direct-drive propellers in aircraft installations.

About eight years ago, Ceskoslovenska Zbrojovka, A.S. in Brno, the leading manufacturer of armament in Czechoslovakia, and the producer of the ZB light machine gun, decided to design a 2-cycle Diesel aircraft engine. Their first design was known as the Model ZV350, a 9-cylinder air-cooled radial rated 350 hp at 1950 rpm. This engine was tested over an extended period and, simultaneously, tests were carried out on a single-cylinder unit so that methods for fuel injection and atomization could be carefully studied, and the process of fuel combustion in the cylinder observed.

Second Design Begun

When these experiments were concluded, the design of a second engine of similar type, the ZOD240A, was started. This engine later completed an approval test of 50 hours under the observation of representatives from the Czechoslovakian Department of State. Following the completion of this test in July 1933, further running on the block increased the total time to about 500 hours. In addition, some 350 hours or more, were accumulated in actual flight. Apparently there has been enough testing to demonstrate the reliability of this power plant.

Its Specifications

The ZV240A engine has a 4.72 in. 120 mm bore, 5.12 in. 130 mm stroke, and a displacement of 806 cu. in. 13.21 liters. Rated sea level output is 260 hp at 1560 rpm, and the weight, 653.4 lbs. 297 kgs. represents a specific weight of 2.51 lbs. The engine measures 46.45 in. outside diameter and approximately 35 in. in overall length. This engine employs a 15:1 compression ratio and, using fuel oil of .882 specific gravity, consumes .429 lb. hp hr. at full load, .396 lb. hp hr. at .9 load, and .385 lb. hp hr. at .75 load. Consumption of lubricating oil ranges from .009 to .015 lb. hp hr. Weight is slightly higher than some of the modern nine-cylinder air-cooled radial engines in the same power class but the saving in fuel may offset this difference in flights of rather short duration.

Details of construction do not differ greatly from the majority of modern engines having a similar cylinder arrangement. Chrome-nickel steel cylinders, provided with the usual circumferential cooling fins, are screwed and shrunk into eads made from heat-treated forgings f a material known as Hiduminium RR 5. Cylinder attachment is accomplished y screwing them into steel nuts in the rankcase. The latter is composed of 2 Hiduminium forged sections joined in he plane of cylinders by 9 through bolts.

The Bearings

The 2-piece single-throw crankshaft is arried by 2 roller bearings and a ball earing, the latter located at the front o carry the thrust load of the propeller. Connecting rods are of the articulated ype, the big end of the master rod being ined with a special lead-bronze composition. Bronze bushings are provided for he piston-pins and wrist-pins, which are made from nitralloy steel. Pistons are ast aluminum-alloy and each has 4 compression rings and two oil-scraper rings.

Dual exhaust valves, inclined in the head of the cylinder and set upon aluminum-bronze inserts, are actuated through rockers and tubular duralumin push rods from a cam keyed directly to the crankshaft. Tappet clearance is taken up by a self-adjusting compensating device.

Fuel is injected and atomized by closed nozzles screwed into each cylinder head. Feed to these nozzles is maintained by a Bosch fuel pump, and regulation of the fuel is effected by rotating the pump plunger. Special discharge valves of the injection pump permit expansion of the fuel in the line after the injection period, thereby eliminating formation of carbon in the nozzle orifices. The cam, which operates the fuel pump through the medium of push rods, is keyed directly to the crankshaft.

Air Starting

The engine is started by air which has been compressed by a vane type compressor. Lubricating oil is fed to the bearings by a pressure pump and returned to the tank by two scavenging pumps.

While the particular two-cycle system employed in the Zbrojovka engine is not new in the Diesel field, it is probably the first time that it has been adapted in a complete design prepared especially for aircraft. Contrary to general design, the fresh air enters the cylinder at the inner (lower) end and the burnt gas is expelled at the top (outer) end. Besides incorporating the feature of the uniflow principle, considered essential for good output in all 2-cycle engines, this arrangement places the hot exhaust valves to the outside where they may be more effectively cooled.

Referring to the accompanying schematic sketch showing the arrangement of the ZOD240A engine, we find the upper piston at the lower or inner end of its stroke where the band of ports in the wall of the cylinder are uncovered to permit air to enter from the individual pipes connected to the annular chamber. This annular chamber is fed under pressure through diffuser vanes from a centrifugal blower driven through gearing at the back of the engine. When air enters the cylinder, it drives the burnt gas ahead of it through the mechanically-operated exhaust valves which, incidentally, have opened a sufficient time prior to the uncovering of the ports so that the pressure within the cylinder has been reduced somewhere near that of the entering air. As the piston ascends, the exhaust valves are closed at the same time the ports are covered by the piston. The fresh air then is compressed until its temperature rises sufficiently to ignite the atomized fuel whose injection begins just before the piston reaches the upper end of the stroke.

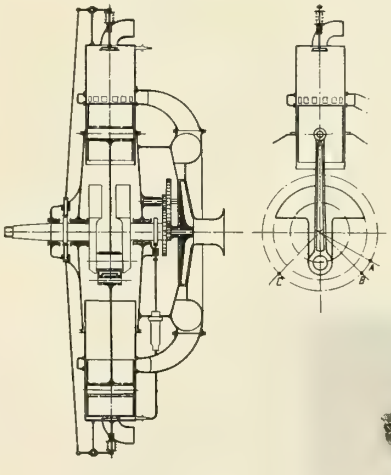
Fuel Injection System

The cam, which controls the opening and closing of the exhaust valves, is shown at the front of the engine. The fuel pump, which is operated by a cam at the rear, is located between the cylinders and the annular chamber for the incoming air. A line leading from the pump is shown connected to the injector in the lower cylinder whose piston is then at the firing position. The injector lies at right angles to the cylinder axis and, due to the tangential entrance of the atomized fuel and the depression in the piston, the necessary degree of turbulence is created.

Perhaps the timing of these functions may be understood more readily by referring to the right hand portion of the diagram. The angular crankshaft travel from A to C represents the period of exhaust valve opening, and during the travel from B to C the band of inlet ports are uncovered by the piston. Thus, the period from A to B represents the angular travel while the exhaust valves are opened for relieving cylinder pressure prior to scavening and inducing the fresh air.

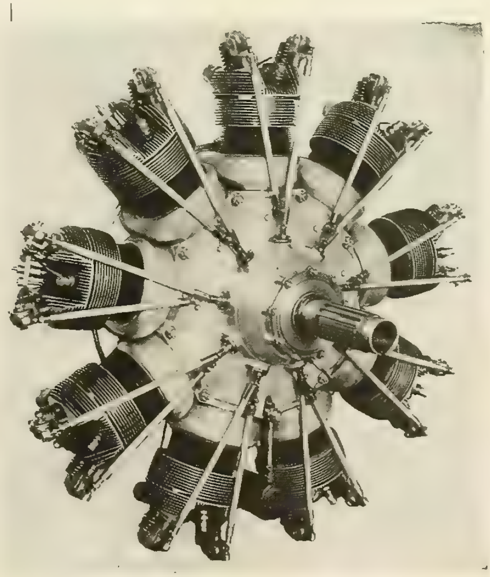
This particular uniflow system for 2-cycle operation is well suited to radial engines, both from a structural and cooling standpoint. Although the system is not new in the 2-cycle Diesel field, it is believed to be the first successful attempt of applying it to a radial for aircraft use.

Manufacturers claim the usual features for which the compression-ignition engine is noted, namely—low fuel consumption, low fuel costs, reduced fire hazard, non-interference with radio apparatus and greater reliability, plus the features of the 2-stroke cycle such as lower weight per horsepower and more uniform torque, the latter making unnecessary the use of special damping devices usually incorporated in order to reduce vibration.



Longitudinal and transverse sections showing the internal arrangement and the operating principles of the ZV 240 A 2-stroke cycle Diesel engine

Propeller end of the Zbrojovka aircraft engine which has been given flight tests



German Military Aircraft

(Part I)

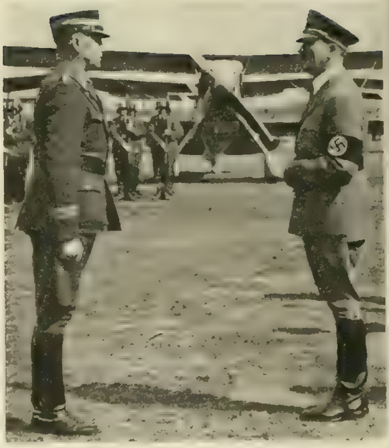
PEYTON M. MAGRUDER and LUCIEN ZACHAROFF

Part I of this series covers the development of the German Air Force—its disposition and strength and the attendant program of expansion and industrial mobilization of the German aviation industry. Bombers and observation planes are briefly covered in a digest of types, constructional features and performances. Part II of this article will describe the various types of fighters, fighter-bombers, training planes and seaplanes used by Germany's air force

● General Hermann Goering, Reich Air Minister, secretly laid the groundwork for the present startling rearmament of Germany's Air Force in 1932. Backed by the entire resources of Germany and possessing unlimited power, he carefully and expertly reorganized existing aircraft factories and built new ones. Slashing the red tape which strangles most military organizations, he planned from the bottom up, unhampered by old and outmoded institutions. Wasting little time or money in an effort to build airplanes which would become obsolete within a few months, Goering and his aides systematically planned for future mass production, for comprehensive development of essential war materials, for a trained organization of pilots, mechanics, and engineers, and for modern air bases, flying fields, and research centers.

Today the strength of the German Air Force is estimated to be approximately 2800 planes—every one modern—with organizational subdivisions as follows: Army, 1700; Navy, 600; civil transport planes readily convertible to military types, 500. However, the true total is probably close to 4000 counting approximately 1800 so-called convertible bomber-transport ships in use in civil aviation. Regardless of the exact number of airplanes, little doubt exists anywhere as to the efficiency of the German air forces.

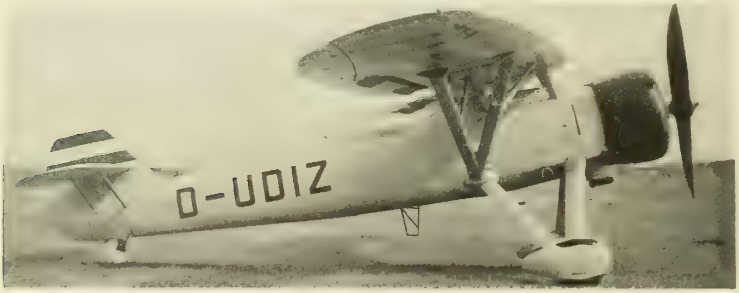
An opinion prevails in some European quarters (and is assiduously cultivated by the Nazi press) to the effect that Germany, having undertaken expansion of her air forces on a broader scale and much later than other countries, possesses the most up-to-date air armada in the world. By 1935, Germany was apparently in the forefront of Western European powers not only in regard to potential production, but also to size of past production—50% of which was accounted for during the first three years of Nazi power by seven or eight of the largest aviation manufacturers, such as Junkers, Heinkel-Arado, Dornier, Henschel, Focke-Wulf, Baerische Flugzeitwerke, and Klemm. The number of employees at the Junkers plants alone exceeded 18,000 with nearly 15,000 employed at Dessau where a capacity production of 1000 fighters a month is readily admitted.



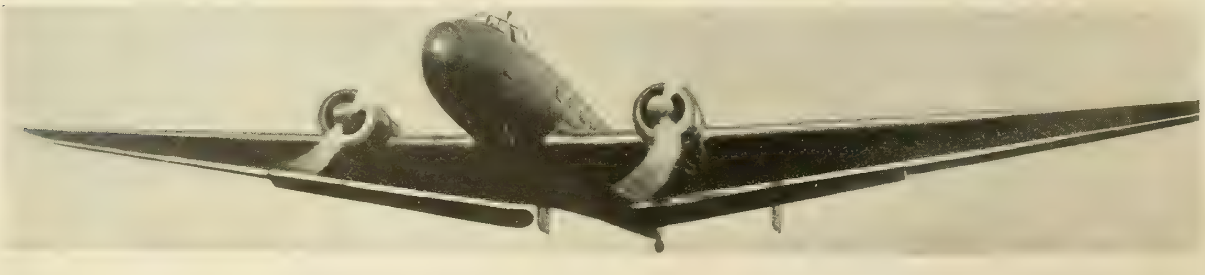
Hitler inspecting military aircraft

The theory of 100% up-to-dateness of German military aviation is not, however, completely justified by the facts at present. Those who espouse it usually overlook the manufacturers' eagerness to receive prompt and remunerative orders for existing models. The German government has found it inadvisable to delay production for large orders of aircraft and engines in the classifications which do not as yet boast of ultra-modern models. Furthermore, it would not, in the absence of adequate and properly trained personnel, authorize mass exploitation of the latest models which demand complex training and skillful handling, both for operation and maintenance.

The real significance of German air power does not become apparent until the Goering system of production is thoroughly studied. Beginning with 17 factories, he consolidated and reduced the number to 12. Approximately half of these plants are designated solely for production, the remainder for development and design. Each development plant produces 12 models of each new type assigned which are put through a constant process of alteration and modification as they are completed. If the final product successfully meets requirements, plans, jigs, and essential equipment are transferred in their entirety to one of the production plants which is highly specialized for mass production of that type. This system, the German military authorities believe, assures maximum output on short notice with minimum effort.



Henschel 122 observation and (below) the Junkers Ju 86



General Goering, Reich Air Minister

Turning from construction plans, the next step was to develop a steady source of raw material and fuel, the two main weaknesses in the German program of rearmament. Deposits of bauxites (aluminum ores) are negligible and, as a result, this highly essential raw material must be imported from France, Hungary, and Yugoslavia. Over 500,000 tons were imported in 1935 and smelted for a war reserve. At present, it is estimated that only 75% of the aviation industry's total possible war requirement is on hand.

High grade fuel must also be imported. Intensive efforts are being made to transfer much of the auto transport to the use of synthetic fuel substitutes in order to save the better natural fuels for aviation. However, it is expected to take at least two more years before Germany will be able to satisfy 70% of her auto transport's needs with domestic products such as brown-coal benzine, benzol, alcohol, and various gases. As for German aviation engines, they are not yet developed to a point which will permit the use of substitutes. Utilization in aviation of heavier fuels has thus far been negligible.

Other necessary raw materials are well provided for from domestic sources with huge quantities of aviation steel, magnesium alloys and aviation woods on hand.

A well organized production system, backed by a steady flow of raw materials, having been assured, Goering's next step was the development of training centers, air bases, and engineers. This was one of the chief problems encountered among the many which faced the Air Ministry. An intense effort was successfully made to bring into the air corps the youth of the pre-war aristocracy and the cream of the younger Nazi generation. Rapid promotion and high pay with its attendant prestige insured to a large degree a wealth of promising material. Personnel training for both military and civil aviation is receiving a great deal of attention accompanied by unusually large appropriations. Special emphasis is being placed on the accumulation of trained reserves for rapid mobilization in a national emergency. The following table shows the tempo of growth of personnel as well as the provident training of large numbers of men even in the earlier years when there was a disproportionately small number of aircraft.

Year	Squadrons and Detachments	Ships in Service	Personnel
1933	36	400	12,000
1934	84	900	28,000
1935	225	1800	42,000
1936	360	2800	55,000

There were 12,000 trained men for 400 ships in 1933. It has been estimated that 90,000 men will be needed in 1937-1938 in relation to the 4800 to 5700 fighting planes planned at present. Of that number 15,000 to 23,000 will be pilots, engineers, and technicians.

Basing themselves on the 1918 depreciation figure of 35% a month, German industrialists have brought the emergency production of German aircraft factories up to 16,000 planes and 20,000 engines a year, for which repair and re-modelling involve annually nearly 8000 planes and 10,000 engines.

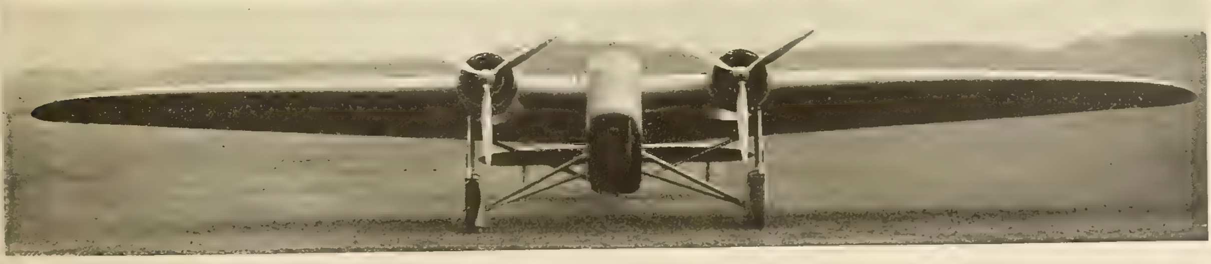
Personnel depreciation varied from 16% to 25% a month during the World War, depending on the branch of service and the nature of military operations, and as a result, the annual capacity of flying and technical schools in Germany has been brought up to 25,000 pilots, engineers, and technicians.

These are staggering figures yet they seem small in comparison with the 50,000 military airplanes and 100 dirigibles Germany produced between 1914 and 1915. When it is recalled that even with her supply of raw material cut off, Germany's output reached 2000 planes a month at the Armistice, the present figures of what the German engineers might do in a future war seem rather tame and a gross understatement rather than the highly exaggerated claims they first appear to be.

At present, the country's twelve major factories (and 20-30 smaller subsidiaries) employ between 90,000 and 100,000 persons—as many as in 1918. Enjoying huge orders, these factories worked two and three shifts daily during 1935-1936. They turned out approximately 4000 planes and 7000 engines during this period with an increase of about 1500 planes and 2000 engines planned for 1936-1937. This increase in production has resulted in a steady increase in the German aviation budget which averaged 84,000,000 marks for the years 1927 to 1931; 211,000,000 marks in 1934; 500,000,000 marks in 1935; and 980,000,000 marks in 1936—a total of more than $400,000,000 in the last three years. These figures do not include the expense of constructing air bases (underground, camouflaged, and bombproof), buildings, and roads essential to military aviation.

Great assistance in developing Germany's new aerial fleet has come from

Dornier Do-23 and (below) the type DoF freight carrier



The twin motored Focke-Wulf FW 58 trainer-observation-bomber transformed from a commercial plane to a military type. It has a speed of 190 miles per hour

DVL, the central research and experimental laboratories at Adlershof which corresponds closely to the NACA at Langley Field. Additional assistance has come from the aeronautical schools at Goetingen, Hanover, Stuttgart, Berlin, and Aachen as well as from the United States, England, Japan, and Italy. Technical and financial assistance in the form of exchanges of aeronautical information and the exportation of airplanes, engines, and accessories has been provided by the two first-named countries. Japan has not only displayed readiness to buy licenses for the manufacture of German aircraft and engines, but also purchases considerable quantities of sights, photographic equipment and similar accessories. Italy's cooperation came in the form of direct exchange of experience as well as in purchases of German raw and semi-raw materials and, particularly, of equipment and war supplies.

The astonishing progress of Germany has thus been due to a variety of factors which have combined to furnish a tremendous impetus towards the development of a number of new and outstanding types of airplanes and engines.

Present Air Force

The German air force of 1936 consists principally of bombers with a smaller proportion of pursuit planes or fighters and observation types. According to European data, the following is the estimated number of military planes of each category now in active service including converted civil types:

Types	Number
Heavy Bombers	800
Light Bombers	600
Fighter-Bombers	300
Fighters	450
Observation	450
Miscellaneous	200
Total	2800

Up to 1935 a number of types had been adopted for active use, such as the Junkers 52 and the Henschel 122. The light bomber, Heinkel 70, was also in quantity production but was equipped with an antiquated engine, the 600 hp BMW. These types had originally been designed in several cases prior to 1933 and were obviously disguised military planes although used for commercial purposes. The Ju 52, the best example of this, was an obvious bomber type although utilized in large quantities by Lufthansa for passenger and cargo transportation. The cabin was readily changed by minor revisions to provide for bomb racks and gunners' cockpits, with a removable roof to provide fittings for machine guns and sights. So many Ju 52's were built that scores were sold throughout the world for less than 10% of their original cost. Others were to be seen stored in the open (all available hangars were filled) at Templehof and other fields.

In addition to the disguised military types in production prior to 1935, there was a large scale output of 150-250 hp training and sport planes. The students' one- and two-place trainers with 250 hp engines, as well as the three-place, twin-engined types, have each been utilized for re-training and perfecting pilots prior to transfer to the latest types which began to appear in 1935. These newer models were both experimental and production types which represented to a large extent the latest developments in German aeronautical science. They were, in general, twin-engined light and heavy bombers and single-place fighters equipped with engines of foreign contemporary design produced in Germany. Some, however, had new German engines of 900-950 hp which had just been produced although planned as far back as 1930.

Prior to 1935, a majority of civil and military types were equipped with BMW VI and IX 500 and 700 hp water-cooled engines, the Siemens 22, a 600-650 hp engine, and the 240 hp Argus 10 air-cooled type. Last year production was begun on the 800 hp Daimler-Benz. Old BMW models are being improved to provide a limit of 950 hp. In addition, there are a number of Rolls-Royce *Kestrels* of 600-650 hp and Pratt and Whitney *Hornets* of 750 hp being produced under license. Production of aviation Diesels is well under way with an outstanding type, the Junkers *Jumo* 205. This engine is rated 600 hp at 2200 rpm and weighs 1.75 lbs./hp. It is being installed in all late models for Lufthansa and is used as standard equipment for two squadrons of heavy bombers. The Dornier Do-18 also employed Junkers *Jumo* Diesels in their recent north Atlantic flights. Equipped with reduction gearing, the *Jumo* develops 700 hp at 15,000 ft. and 2300 rpm. Junkers is understood to be experimenting on a 2000 hp engine (at 3400 rpm) which so far has proved entirely satisfactory during preliminary tests.

The latest bombers to be adopted including the Junkers Ju 86 and the Heinkel He 111 have maximum speeds from 228 to 256 mph. New flying boats, the Dornier Do-18, for example, are capable of speeds up to 155 mph. New fighters of Heinkel, Arado, and Dornier design have

Two versions of the trimotored Junkers Ju 52. This all metal heavy bomber may be used as a bomber-transport or converted for civil use as a carrier of freight

peeds in excess of 270 mph and several, t is claimed, better than 300 mph.

Heavy Bombers

There are four standard bombers now n active service in the German air force:

Type	Total Number	Total HP	Gross Weight (pounds)	Maximum Speed (mph)
Junkers 52	550	1980	20,900	180
Junkers 86	250	1500	15,000	208
Dornier 23	300	1500	20,240	162
Heinkel 111	300	1760	15,200	256

The Ju 52 heavy bomber is a military conversion of the Junkers Ju 52/3m civil transport plane which may be equipped as a passenger or freight carrier or as a bomber-transport. A low-wing cantilever monoplane, the Ju 52 has a number of unusual features such as a stressed skin fuselage built up of dural frames and four longerons covered by corrugated aluminum alloy sheeting; a swept back and tapered all-metal wing, in three sections, with a basic structure consisting of eight dural tubular spars arranged vertically in pairs; and a trailing edge flap of the external airfoil type designed to function either as a differentially controlled aileron (outboard portion only) or as a camber changing flap. The combination flap-aileron is by far the outstanding feature not only of the Ju 52, but also of the Ju 86, Do 23, and other German heavy monoplane types. Adding a large increment to the lift of the basic wing, this flap has little more drag than that of the wing alone and has only two slight disadvantages, which are: a more complicated control system, and adverse yawing moments at high angles of attack. It is said that these disadvantages are more than offset, however, by the greatly increased lift, decreased drag, and improved lateral control. The Ju 52 may be equipped with either three 660 hp BMW *Hornet* nine-cylinder radial air-cooled engines, or three 500/560 hp Junkers *Jumo* 205 six-cylinder vertical two-stroke opposed-piston compression-ignition water-cooled engines. Performance varies slightly between the land plane and seaplane twin-float type. As a land plane with three *Hornets,* the Ju 52 weighs 12,540 lbs. empty and 20,900 lbs. loaded and has a maximum speed of 180 mph, a range of 546 miles, and a service ceiling of 19,020 ft. As a seaplane, the maximum speed is 173 mph, loaded weight 20,000 lbs., and range 521 miles. With three *Jumo* Diesels, maximum speed of the land plane is 165 mph, service ceiling 21,648 ft., range 776 miles, and weight fully loaded 20,900 lbs. The seaplane with Diesels weighs 22,000 lbs. and has a maximum speed of 159 mph, ceiling 19,352 ft., and range of 740 miles. Twin machine guns are Scarff-mounted above the fuselage just aft of the pilot and below amidships in an underslung turret. Approximately 2500 lbs. of bombs may be carried.

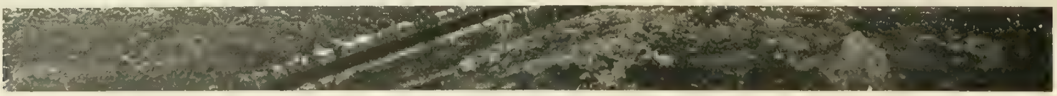
The latest Junkers bomber, the Ju 86, is a development of the Ju 52 using the same type of wing, but has an oval fuselage with a smooth stressed skin, retractable landing gear, and two instead of three *Hornets* or *Jumo* Diesels. The Ju 86, with which several bomber squadrons have been equipped, is being produced in large numbers for commercial as well as military use. With the *Jumo* compression-ignition engines, a maximum speed of 199 mph is obtained at 8200 ft. Two 700 hp *Hornets* give a top speed of 228 mph, a cruising speed of 200 mph, and a service ceiling of 23,000 ft. Armament is similar to that of the Ju 52, however, the Ju 86 weighs only 15,000 lbs. fully loaded.

One of the first German heavy bombers was the Dornier Do-23, a converted and improved modification of the Do-F transport, a high wing semi-cantilever monoplane. Constructional features of the Do-23 include: a wing structure built up of three dural spars and ribs, the whole fabric-covered; and an all-metal monocoque fuselage of rectangular section covered with light aluminum alloy panels. The power plant consists of two 750 hp BMW twelve-cylinder Vee engines mounted in front of the leading edge of the wings, one on either side of the fuselage. Ethyl-glycol cooled engines drive four-bladed wooden propellers and give a maximum speed of 162 mph, a landing speed of 54 mph, a ceiling of 19,020 ft., and a range of 745 miles. Empty the Do-23 weighs 12,430 lbs. and fully loaded 20,240 lbs. Armament consists of six machine guns mounted in pairs with two in the forward cockpit and two aft both above and below the fuselage.

The Heinkel 111, an all-metal twin-engine attack bomber is equipped with 880 hp Mercedes-Benz engines. A cantilever monoplane, the He 111 features retractable landing gear, monocoque construction, external airfoil flaps, and exceptionally clean aerodynamic design. Although details of construction of this type are secret, performance is known to include a maximum speed of 256 mph, cruising range of 1060 miles and a bomb capacity of 2400 lbs.

(*Continued on page* 31)

DAYTON IMPROVES ITS MUNICIPAL AIRPORT



GEORGE F. BAKER

Director of Service & Buildings and City Engineer, Dayton, Ohio

● Lack of adequate runways at the Dayton, Ohio, Municipal Airport necessitated modernization of the field if the city was to keep its place in commercial aviation. Public-spirited citizens and local officials therefore instituted an airport improvement program, first raising $65,000 for purchase of the leased airport site so that WPA funds could be obtained, and then having $19,125 appropriated as the city's share of a $673,496 project.

The Dayton Municipal Airport at Vandalia is nine miles north of the city and is situated on a tract of land at an altitude of 1000 feet above sea level. Rectangular in shape, on level ground, the airport offers pilots an all-way landing site. The name "Dayton" is imbedded in the field for purposes of identification from the air.

Facilities for night flying operations include a complete installation of boundary, approach, flood and obstruction lights. In addition, there are aircraft and engine servicing facilities, both during the day and at night.

Realization that the city's airport must have the most modern facilities to attract and to keep airline business was instrumental in having city officials initiate plans for the construction of new and adequate runways as the first step in their modernization program. Work direction was turned over to a group including F. O. Eichelberger, city manager; H. J. Derivan, local district WPA director, and the author.

After title to the property in Vandalia was taken in April of this year and the Bureau of Air Commerce had approved the project, construction was immediately begun. Paving operations started in July and it was expected that all pavement would be in place by last month.

Appropriations were earmarked for the following items: 160,000 sq. yd. of concrete pavement; 148,000 cu. yd. of rough excavation; 15,000 cu. yd. of top soil excavation; 71,000 sq. yd. of sodding; 500,000 sq. yd, of fine grading; 600 rods of fencing; 22,000 lin. ft. concrete pipe drains (10"–24"); 42,000 lin. ft. side drains (4"–8"); 90 manholes; and 90 inlets.

In the 54 working days up to and including September 26, a total of 98,552 sq. yd. of pavement was placed, an average of over 1,800 sq. yd. per day. Up to that time the cost per sq. yd. had been as follows:

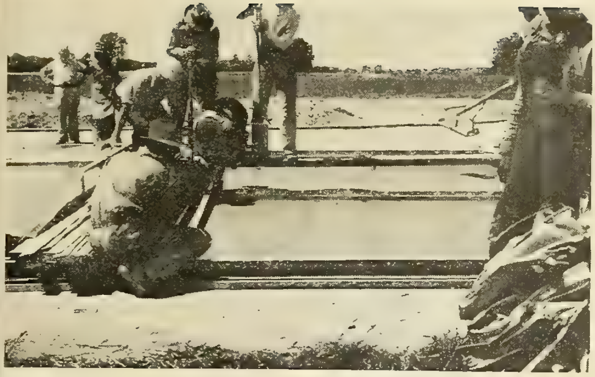
Materials:		
Sand and gravel	$0.301	
Cement	0.453	
Miscellaneous	0.023	
Total materials		$0.777
Equipment		0.123
Labor:		
Subgrading	$0.068	
Setting forms, mixing, placing, finishing	0.265	
Curing	0.079	
Total labor		$0.412
Total cost per sq. yd.		$1.312

As the crews became more experienced, even better progress was made, the daily progress ranging up to 3,000 sq. yd. and costs being lowered materially.

Modernizing the Runway System

The accompanying layout shows four runways, each 100 ft. wide and from 2400 to 4000 ft. in length. In addition there are two taxiways and an apron surrounding the hangars. Each 100-ft. wide runway is made up of five 20-ft. strips. Tongue and groove construction joints between adjacent strips prevent irregularities in the surface due to differential subgrade movement. The center 15 ft. of each strip is 5 in. thick, increasing in the outer 2½ ft. to 7-in. thickness at the edge. There is a longitudinal dummy joint in the center of each 20-ft. strip and ½ in. round deformed tie bars, 30 in. long, across it at 4-ft. intervals. The function of this joint is to prevent irregular longitudinal cracking.

Standard mixing and finishing equipment and methods give satisfactory results at Dayton Municipal Airport, Vandalia, Ohio



Dummy joints are formed by forcing metal strips into pavement, then filling space with bitumen

There are no longitudinal expansion joints but transverse expansion joints are provided at 100-ft. intervals. These joints are 1 in. thick, of premoulded bituminous filler and equipped with ¾ in. round steel dowels 2 ft. long on 1 ft. centers, each dowel being painted, oiled, and capped on one end to permit free movement. Dummy construction joints, with corner dowels only, are provided at 20-ft. intervals between expansion joints.

An inverted crown is used, the water being removed through inlets about 24 in. in diameter at 150-ft. intervals along the center of each runway. In this way a considerable saving was effected in the cost of inlets and the problem of widening the runways at a later date was simplified. Another advantage of this design is that it prevents the softening of the turf adjacent to the runways by the run-off from them during heavy downpours. This type of crown has proven satisfactory in several years use on the concrete runways at Lunken Field, Cincinnati.

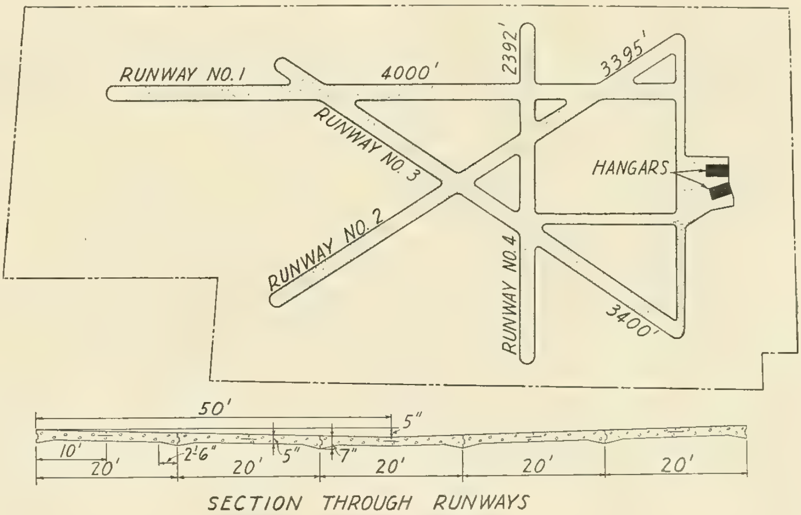
There were 566 men employed on the project exclusive of engineering and supervising forces. This included men working on grading and drainage as well as the paving operations. The men worked in two six-hour shifts of 283 men each. The makeup of each shift and the hourly rate of pay are as follows: Skilled labor: 9 finishers and 2 form setters, at $1 per hour; 1 grader operator, $1.20; semiskilled labor: 26 men, $0.65. Common labor: 245 men, $0.48.

Equipment used and hourly rental rate thereon was as follows:

1 pump for water supply	$2.40
1 road roller	3.80
1 27-E paving sizer,	5.95 (including operator)
1 finishing machine,	3.20 (including operator)
1 7-S concrete mixer	1.15
1 tractor	4.25
1 grader	1.50
1 subgrader	0.75
1 trail grader	0.75
Forms (3400 lin. ft.)	$40 (per month)
Pipe for water supply	50 (per month)
Bridges 6-float	80 (per month)

Sand and gravel, meeting the specifications of the Ohio State Highway Department, were delivered in batch trucks from washing plants 9 to 11 miles distant. The cost of both sand and gravel was $1.68 per cu. yd. delivered. Cement was hauled from a railway siding three miles from the airport and water was obtained from local wells, pumped to an elevated supply tank.

The concrete materials were proportioned by weight, the batch quantities being six bags of cement, 1350 lb. of sand and 2200 lb. of gravel. With a water-cement ratio of 5½ gals. per bag of cement, strengths at 7 days averaged 3500 lbs./sq. in. in compression.



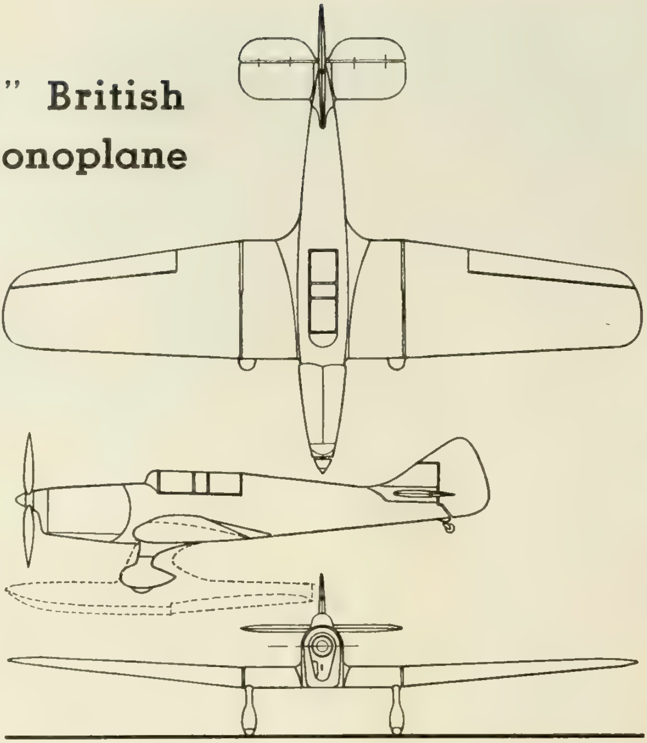
Plan and cross section of the four runways, also taxiways and aprons

Tie bars and dowels were held in place during the paving operations by metal chairs which remain in the concrete. The dummy joints, longitudinal and transverse, were formed by forcing a metal strip (which is later removed) into the surface of the newly finished pavement. This leaves a groove to be filled with bitumen. Final finishing was with a longitudinal float and a belt.

The pavement was cured for 24 hours with wet burlap, placed as soon after finishing as the condition of the concrete allowed. When the burlap was removed, curing was continued by covering the pavement with hay cut from areas adjacent to the runways. This hay remained in place and was wetted down for 7 days.

The longitudinal steel float used to produce the smooth, even surface necessary on runways

The Miles "Mohawk" British Long Range Light Monoplane



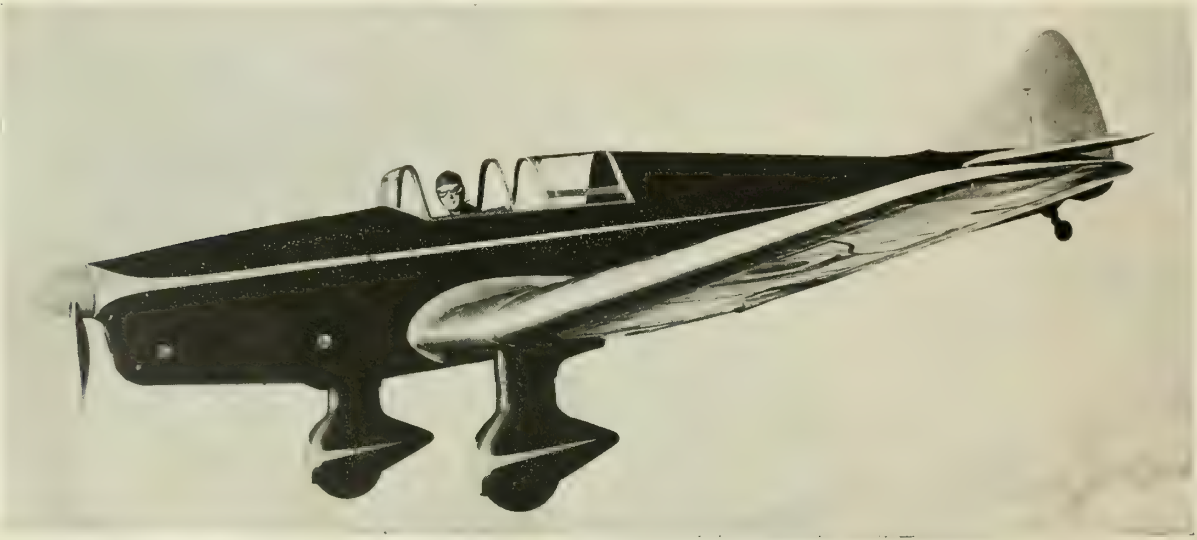
● The Miles *Mohawk* was built by the British firm of Phillips & Powis to meet the requirements of Col. Lindbergh whose conferences with F. G. Miles, director and chief designer of Phillips & Powis, resulted in the production of the *Mohawk,* a long range, high speed monoplane. Essentially a typical Miles two-place job, the new plane differs from its predecessors in the cockpits, landing gear, tail unit, and the use of a supercharged American-built Menasco engine.

Structurally it is all-wood construction following standard Miles practice. Fuselage is of the box structure using plywood and spruce with stressed skin construction. Seats are arranged in tandem and are mounted on front and rear spars. The sliding canopy top enclosure, incorporating a long fairing which tapers away to the fin, is of an inverted V section. Between the seats is a fixed portion of the enclosure, but flexible panels above each occupant meet on the center line of the fuselage. These panels can be pushed down into the sides of the fuselage.

Aft of the rear seat there is a large baggage compartment accessible both from the cockpits and the starboard side of the fuselage. Behind this compartment is stowage space for a tent, a 10-lb. collapsible life-raft and other articles which might be taken on a long trip. Backs of the seats are removable and are so designed that they can be laid flat with the seat bottoms to form a bed. Provision is made for dual controls which incorporate an elevator trimming device. Since the elevator tabs become comparatively ineffective at low speeds, the operating gear is designed to adjust the tabs in the conventional manner at high speeds, and at low speeds for landing, to load the elevator control.

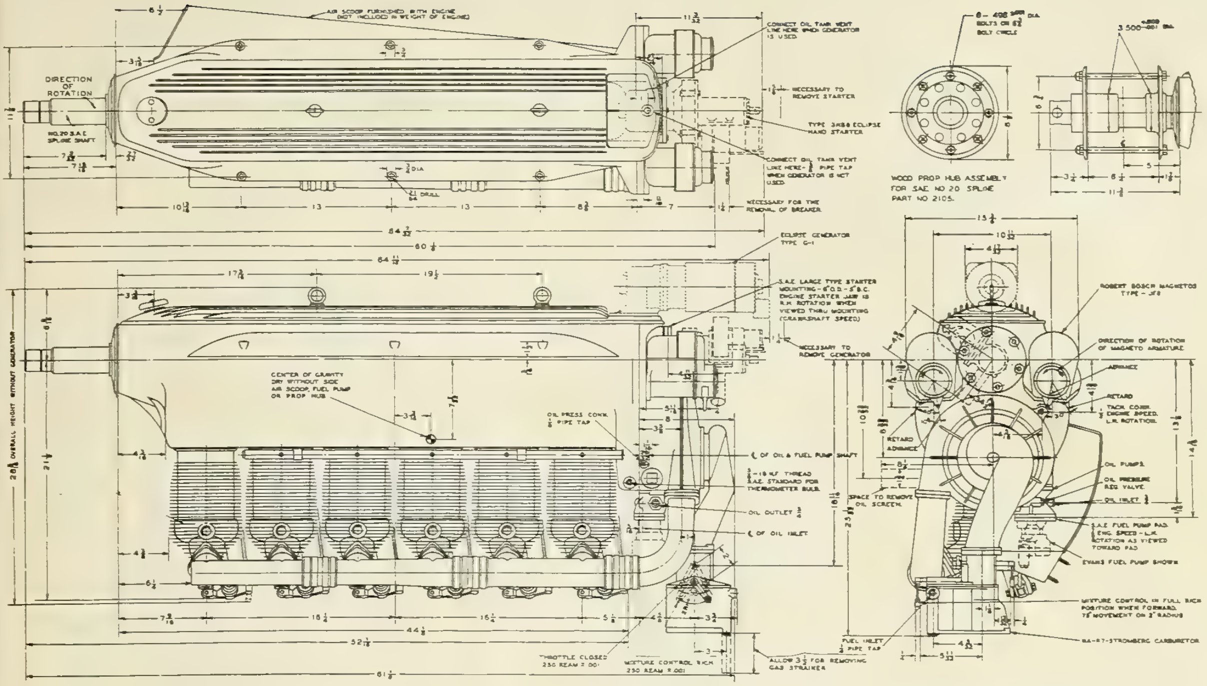
Wings are in three sections—the two outer panels and the center section. The outer panels incorporate two spars and a plywood covering taking drag and torsional stresses. The center section, built into the fuselage, consists of two built-up wood box spars and wood ring type box ribs. In addition to the tanks in each of the outer panels, there are two in the center section. Miles-type split trailing edge flaps also are provided.

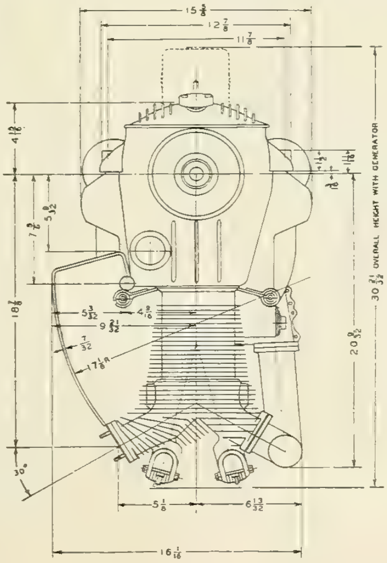
Cantilever design has been followed in construction of the empennage in which wood covered with fabric has been used.



Wide World photo

Colonel Lindbergh flying his Miles Mohawk which is powered by a 200 hp Menasco Buccaneer engine


AIR SCOOP FURNISHED WITH ENGINE (NOT INCLUDED IN WEIGHT OF ENGINE)
DIRECTION OF ROTATION
NO. 20 S.A.E. SPLINE SHAFT
CONNECT OIL TANK VENT LINE HERE WHEN GENERATOR IS USED
NECESSARY TO REMOVE STARTER
TYPE 3488 ECLIPSE HAND STARTER
CONNECT OIL TANK VENT LINE HERE - 1/8 PIPE TAP WHEN GENERATOR IS NOT USED
NECESSARY FOR THE REMOVAL OF BREAKER
ECLIPSE GENERATOR TYPE G-1
S.A.E. LARGE TYPE STARTER MOUNTING - 6" O.D. - 5" B.C. ENGINE STARTER JAW IS R.H. ROTATION WHEN VIEWED THRU MOUNTING (CRANKSHAFT SPEED)
NECESSARY TO REMOVE GENERATOR
CENTER OF GRAVITY DRY WITHOUT SIDE AIR SCOOP, FUEL PUMP OR PROP HUB
OIL PRESS CONN. 1/8 PIPE TAP
℄ OF OIL & FUEL PUMP SHAFT
3/8-18 N.F. THREAD S.A.E. STANDARD FOR THERMOMETER BULB
OIL OUTLET 3/4
℄ OF OIL INLET
THROTTLE CLOSED 250 REAM ± .001
MIXTURE CONTROL RICH 250 REAM ± .001
ALLOW 3 1/2 FOR REMOVING GAS STRAINER
28 3/8 OVERALL HEIGHT WITHOUT GENERATOR
84 7/32
80 1/8
84 11/32
61 1/8
WOOD PROP HUB ASSEMBLY FOR SAE NO 20 SPLINE PART NO 2105.
ROBERT BOSCH MAGNETOS TYPE - JF6
DIRECTION OF ROTATION OF MAGNETO ARMATURE
ADVANCE
RETARD
TACH. CONN. 1/2 ENGINE SPEED. L.H. ROTATION
RETARD ADVANCE
SPACE TO REMOVE OIL SCREEN
OIL PUMPS
OIL PRESSURE REG. VALVE
OIL INLET 3/4
S.A.E. FUEL PUMP PAD ENG. SPEED - L.H. ROTATION AS VIEWED TOWARD PAD
EVANS FUEL PUMP SHOWN
MIXTURE CONTROL IN FULL RICH POSITION WHEN FORWARD. 75° MOVEMENT ON 2" RADIUS
FUEL INLET 1/2 PIPE TAP
NA-R7-STROMBERG CARBURETOR



Installation drawings of the Menasco Buccaneer engine

Undercarriage is of the fixed single leg type incorporating brakes, airdraulic struts and streamlined fairings. The tail wheel is fully swivelling. A float undercarriage has also been designed for this job, being noteworthy in that there are no cross struts.

Three International parachute flares are mounted horizontally in the rear end of the fuselage.

Power is supplied by a Menasco B6S six-cylinder in-line engine which was made in this country, although Phillips & Powis have the license to manufacture these engines abroad. This engine, actually a preview of Menasco's 1937 *Buccaneer,* delivers 200 hp at 2250 rpm at 4500 ft. The 1936 model was described in detail in the July 1936 issue of AERO DIGEST. Changes incorporated in the new engine over prior models are primarily the provision for an electric generator and a hydraulically controllable pitch propeller, although the *Mohawk* at present has a Fairey fixed-pitch metal propeller. The new innovations in the engine involved the use of a heavier crankcase with #20 SAE spline hub end and provision for oil passages and mount for hydraulic control mechanism, which incidentally is not on the Lindbergh engine. Menasco also has provided a new type cover incorporating a detachable generator mount and drive.

The engine is mounted in blocks of brake lining and small springs, allowing a .125 in. compression. While the supercharger gives a somewhat longer engine than is usually seen in small, light planes, the use of rudder pedals (which are adjustable) instead of a bar, permitted installation of the engine and controls in less space than originally expected.

Complete performance figures are not available at this time, but maximum speed is believed to be about 200 mph.

Specifications of the Miles *Mohawk* with the 200 hp Menasco B6S *Buccaneer:*

Wing span	35 feet
Overall length	25 feet 6 inches
Overall height	6 feet 6 inches
Wing area	182.75 square feet
Empty weight	1605 pounds
Useful load	1095 pounds
Gross weight	2700 pounds

GERMAN AIRCRAFT

(*Continued from page 27*)

Observation Planes

There are only two observation or reconnaissance types now in active use although a number of new models are in the process of development and are expected to be put into general use just as soon as production schedules permit.

The Focke-Wulf 58 was produced in quantity in 1935-1936 as a trainer-observation-bomber type as well as for civil use. The illustrations on page 26 show clearly the transformation from the commercial plane to the military type. Equipped with inverted 240 hp *Argus* engines, the FW 58 attains a maximum speed of 190 mph, a range of 710 miles, and a service ceiling of 19,000 ft. Weight fully loaded is approximately 11,500 lbs. Armament consists of machine guns, Scarff-mounted fore and aft.

The only pure observation type in general use is the Henschel 122, a two-place high-wing rigidly braced metal- and fabric-covered monoplane. The swept back metal two-spar wing has tapering ailerons and camber changing flaps from the ailerons to the center section cut-out. Fuselage is elliptical and of metal monocoque construction. A Siemens SAM 22 nine-cylinder radial air-cooled engine (NACA cowled) provides a maximum speed of 168 mph, landing speed of 51 mph, service ceiling of 21,648 ft., and a range of 375 miles. Empty the Hs 122 weighs 3696 lbs. and fully loaded, 5632 pounds.

(*To be continued in the January issue*)

Airplane Flight to and in the Stratosphere

●

RUSSELL J. SMITH

● Increase in maximum speed of modern aircraft at various altitudes, assuming thrust hp available to be constant, is calculated to be approximately 0% at sea level, 10% at 10,000 ft., 22% at 20,000 ft., 36% at 30,000 ft., and 54% at 40,000 ft. These figures follow closely a curve $Vg_{\max}.\sqrt[3]{\rho g/\rho a}$; that is maximum speed increases with altitude, assuming constant power, approximately as the cube root of the air density ratio. Advantages of flying at altitude have been known in the past, but only recently has the possibility of their realization been brought close.

Advantages of stratosphere flight still depend on the solution of certain problems, and it will be the purpose of this and a subsequent article to group and discuss some of these major problems.

Design Characteristics of Stratoplanes

The size of an airplane is important in obtaining high speed and flight efficiency, known here in terms of the L/D ratio, for stratoplanes as well as for conventional planes. The ultimate airplane is probably the "flying wing" type.

A conventional airplane consists of a wing to which is added elements resulting in some drag but practically no lift to the combination as an airplane. The wing alone has a certain L/D for each attitude which ratios are therefore materially decreased in the airplane combination depending on the quantitative effect of the sum of these features. The result is decreased speed.

In a large airplane having the same wing and power loading as a smaller craft and the same landing speed, takeoff and climb, the wing size dwarfs the elements producing this drag to such an extent (as merging the fuselage and wing root) that the polar curve of the airplane is practically the same as that of the wing. An approach to the highest L/D values possible, those of the wing alone, is thus made resulting in the ultimate speeds and flight efficiencies. In general, when the airplane's size is such that the flying wing state is reached (the airplane and wing polar curves are identical) no material gain in high speed or flight efficiencies may be expected from a further increase in size, other things being equal.

The equation $P = W(C^2d/C_L^3)^3(2W/\rho A)\tfrac{1}{2}$ derived from the ordinary fundamental formulas of aerodynamics, indicates that the maximum altitude, with a certain constant power available, can be reached by reducing the coefficient of power $(C^2d/C_L^3)\tfrac{1}{2}$ and the wing loading W/A.(1)

Considerations of this section indicate that the polar curve of a stratoplane could advantageously have great efficiency, L/D and small coefficient of power $(C^2d/C_L^3)\tfrac{1}{2}$. A polar curve having these characteristics is obtained, in general, by using a wing with a high lift coefficient, a reasonably low profile drag and a high aspect ratio.

Such criteria are used in conventional airplane design but for stratoplanes, in some cases, they require a somewhat changed emphasis.

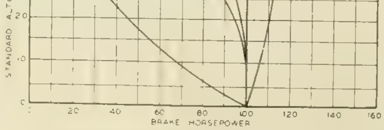
Engines

Stratosphere flying presents the problem of keeping the available sea level thrust hp of the engine from decreasing materially up to and in the lane of operations, the engine and propeller combination making up this problem.

Engines in modern aircraft are practically all gasoline internal combustion types. The density of the air and the power of such engines is closely related. The indicated power developed by these engines depends on the weight of fuel which can be properly consumed per unit of time and this in turn depends on the weight of air supplied to give complete combustion.

At a constant crankshaft speed, because the induction of air by such an engine is at constant volume per cycle, the weight of air pumped as well as the indicated power will vary as the density of the air. Since the friction hp of such engines is practically constant or independent of the indicated power, the brake hp resulting from a combination of these two factors would therefore decrease more rapidly than the density with increasing altitude. At an altitude of about 65,000 ft. the indicated power and friction hp are about equal and brake hp becomes zero.

Two general methods used to overcome this difficulty and increase brake hp at altitude are:



A—Unsupercharged engine. B—Net engine power, Roots supercharger. C—Net engine power geared-centrifugal or vane type supercharger. D—Net engine power turbosupercharger. E—Total power developed carburetor pressure 29.92 in. of HG. exhaust pressure atmospheric

1—use of an oversized or superdimensioned engine so large that it would give the desired power when running with wide-open throttle at the altitude at which the airplane is intended to fly and operated at partial throttle at all lower altitudes to prevent self-ignition and overloading caused by the denser air in the lower levels. It would seem difficult, even with development, to design such engines to work through a range of sea level to stratosphere densities.

2—use of an engine that gives the desired power at the ground and to which is added a device to precompress or supercharge the cylinder inlet air, when desired, to a pressure greater than the barometric at high altitudes of operation. Such engines are found in increasing numbers today. A study of the engine and supercharger combination indicates the possibility of solution of this portion of the problem of constant power.

The Cooling Problem

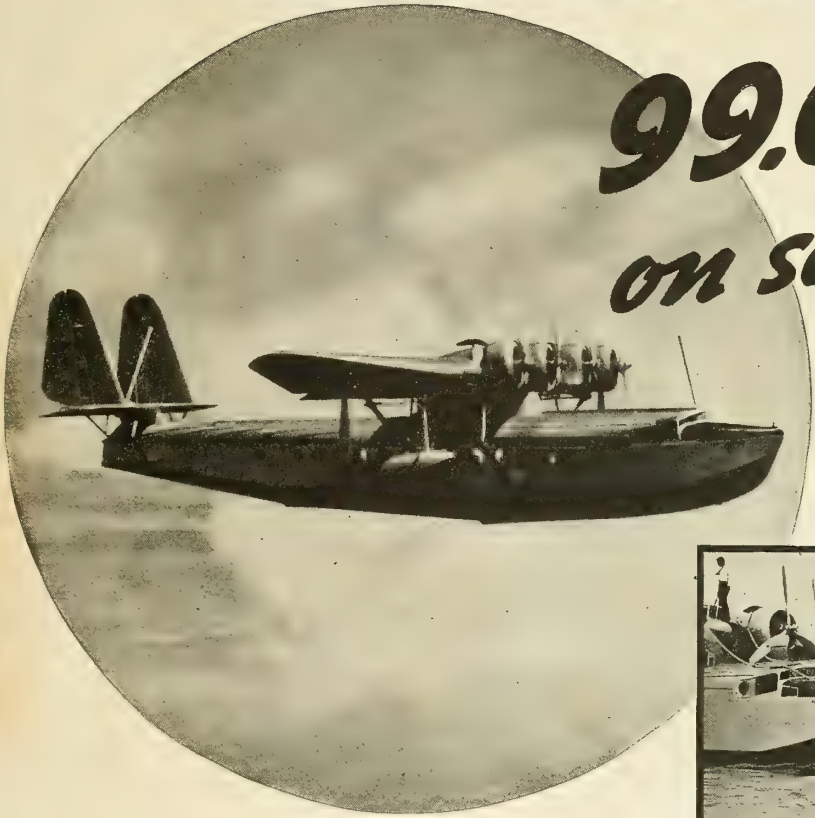
The cooling problem is somewhat different in the stratosphere. Cooling rate depends on the temperature difference between the entering air and the radiator liquid or cylinder to be cooled and on the mass flow of the air, which is proportional to both its density and velocity. In the stratosphere, the effect of the low entering air temperature (—67° F.), and the expected increase in velocity of the stratoplane would be to increase the heat transfer but the decrease in density decreases the heat transfer. With certain assumptions, it has been found that more radiator surface is required in the stratosphere than for sea level operation.

There are also ignition difficulties in stratosphere operations, where the low atmospheric pressure causes sparking in the wiring and magnetoes rather than in the plugs. This has been overcome in some cases by placing the whole system under supercharged air.

A Diesel engine will pick up revolutions on ascending from sea level to 10,000 ft. It does not lose its power output as rapidly with increasing altitude as the gasoline engine—probably because of its higher compression ratio and the normal combustion conditions in the cylinder of an over-supply of air and oxygen to the amount of fuel consumed. Engine revolutions decrease less rapidly than in a gasoline engine when above 10,000 ft., and a 350 hp gasoline engine at sea level and a 225 hp Diesel engine at sea level have equal performance at 20,000 ft.

(*Continued on following page*)

THREE HUNDRED MILLION PASSENGER MILES



99.678% on schedule

OVER routes blazed by Lindbergh . . . the flying Clipper Ships of the Pan American Airways have carried passengers and mail for eight years . . . with an over-all record of 99.678% on time.

And TEXACO AVIATION GASOLINE has helped Pan American maintain these schedules.

Surely a record to be proud of. Surely an outstanding testimonial to the uniform quality and dependability of Texaco Products.

One of the reasons why Pan American, T.W.A., Delta, Hanford, and other airlines choose Texaco Aviation Gasoline is its exceptionally well balanced *distillation characteristics.*

This quality of Texaco Aviation Gasoline provides maximum power, *and definitely reduces the possibility of carburetor icing.*

Whether it be on the charted routes of the transports or among the clouds with the test pilots there is a Texaco Aviation Gasoline of the correct octane rating for your equipment.

Texaco Airplane Oils are made by special refining processes to obtain their extreme purity. They are free from harmful gum and carbon forming elements. Many of the leading airlines use them exclusively.

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TEXACO T REG. T. M.

TEXACO *Aviation Products*

(*Continued from preceding page*)

Steam engines in operation, with development, may be suitable for stratosphere work. The power output of this type would depend partially on the steaming ability of the boiler which in turn depends on the weight of air inducted per unit of time for combustion of the boiler heating fuel. In this case of external combustion it is unnecessary to compress the air; it is necessary only to supply the weight per unit of time. In the stratosphere the density of the air is less, but the expected increase in forward velocity of the plane would tend to scoop more volume of air per unit of time into the combustion chamber and thus balance conditions as against lower altitude operation. In addition, the proportion of oxygen in the atmosphere does not decrease materially with altitude. Therefore, the power of a steam engine could be maintained about constant at all altitudes.

A steam engine condenser and the inlet air would be effected as mentioned previously under cooling.

The fuel consumption of steam engines is slightly greater than that of internal combustion engines.

The weight of steam engines against internal combustion engines with their necessary superchargers would again be a basis for contention. On this basis, the altitude at which the two types are on an equality might be such that the future steam engine, with development, would surpass the internal combustion type for flight power in the stratosphere. While recent experimental flights of an airplane with steam power indicate attention to this type of engine, the present solution, however, of this portion of the problem of maintaining sea level power at altitude seems to be in the use of an internal combustion engine and supercharger combination or unit.

Superchargers

If the engine is to maintain sea level power at altitude, without material diminution, it must be supplied with inlet air of sea level conditions of pressure and density. In the past, the supercharger has been considered a separate and additional unit of the engine. It is believed that advantage in design and performance would result if the engine and supercharger combination were regarded as a single unit, especially for high altitude airplanes. The rear portion of a radial engine's crankcase has a suitable shape for the installation of a supercharger of a certain type. The supercharger is now being built into some engines. The practice of supercharging has increased materially during the last few years and in general it might be stated that it is now in the practical stage for altitudes up to about 20,000 ft.

A workable supercharger might be designed as the result of a comparison involving theoretical performance characteristics and practical limitations, inasmuch as theoretical performance curves of various types of superchargers in combination with a hypothetical engine of approved design are available. The curves are typical and indicate that the turbosupercharger and geared centrifugal supercharger are promising types.[2]

The turbosupercharger curve would indicate that sea level power could be maintained without diminution up to an altitude of about 40,000 ft., the result most desired here. The geared centrifugal supercharger appears next best with a loss of 15% in power at 40,000 ft., and proven feasible in the recent 49,967-ft. altitude flight by the Bristol-Pegasus powered stratoplane described in the November, 1936 issue of AERO DIGEST. The unsupercharged engine power falls off rapidly with altitude. The engine with 29.92" Hg. pressure at the carburetor and atmospheric pressure at the exhaust shows a slight increase in power with altitude, amounting to 15% at 40,000 ft. due to reduced back pressure. The supercharged engine cases are found between these extremes.

These curves show that below 20,000 ft. there is little difference in net engine power of different supercharger and engine combinations. Flight tests a few years ago serve as some check of the curves with the practical results.[3] The tests indicated that a Roots type supercharger required 24% and a turbosupercharger 14% of the engine bhp at 22,000 ft. At 10,000 ft. the Roots and turbocentrifugal required 12% and 6% of the power respectively.

The centrifugal supercharger consists of a casing shaped somewhat like a snail shell and enclosed in this casing and mounted on an axis eccentric to it, a rotating impeller. This unit gives the air which enters it at the axis of the impeller, a velocity head as it reaches the impeller exit at the circumference, due to the action of centrifugal force, and transforms this velocity head into a pressure head in the casing. Vanes are provided on the impeller and casing to guide the air efficiently and to act as strength members as well. Alloys of aluminum and magnesium are used in the construction of the impeller and casing.

If the centrifugal supercharger is driven by an exhaust-gas turbine, it is generally known as a turbosupercharger. The exhaust gases of the engine are led through a manifold and collected in a nozzle chamber to be spent in actuating a turbine wheel, generally mounted on the same shaft as the supercharger impeller, by passing through its blades from nozzles to the atmosphere.

Centrifugal superchargers driven by the engine through gears are known as the geared centrifugal type. A train of gears is interposed between the engine and impeller to multiply the rotative speed of the engine crankshaft up to normal operating rpm for the impeller.

The impeller peripheral speed must be high to reduce the number of stages and the weight and bulk of the compressor; with the diameters used, rotative speeds are sometimes 30,000 rpm.

Any single included curve represents the theoretical results obtained from a series of superchargers of that type, each designed for one particular altitude. However, in practice, the best single supercharger for a range of altitudes must be considered. The method of control determines to a great extent the resultant performance as altitude range is increased, and the ideal method is one where engine demands can be met by varying the air to the supercharger without throttling.

Turbosupercharger

The turbosupercharger method of control approaches this ideal. The amount of exhaust gas by-passed to the turbine wheel determines both the quantity and pressure of the supercharger air for the engine. The highest altitude at which the turbosupercharger can satisfy engine requirements is reached when all exhaust gases are passed through the turbine wheel. Because of the method of control, a turbosupercharger could probably be used satisfactorily through a large range of altitudes.

The geared centrifugal supercharger uses the throttling method of control. At low altitudes, the quantity of air entering the supercharger is throttled to prevent engine over-loading. The throttled air in the supercharger must then be compressed to sea level pressure. This procedure, however, requires power from the engine for the compression, the compression causing high carburetor air temperature, thus decreasing the weight of the inducted charge and resulting in unsatisfactory net engine power at low altitudes.

This loss in power is especially harmful since it increases the time of climb to a certain altitude. The advantage of saving time and increasing range by flying fast at a certain altitude, the plane having a fixed duration, would then be partially offset by the time used in climbing to that altitude.

Turbosuperchargers have had certain troubles of an inherent nature which have been somewhat alleviated today. Departures from theoretical curves of actual engine and turbosupercharger combinations have been due, among other reasons, to the inability of materials of construction to withstand the temperatures resulting from contact with the exhaust gases. Cracking and leaking of the exhaust header to the turbine, due to vibration and temperature stresses induced from its somewhat rigid attachment to the cylinders, has been overcome only with some difficulty. The exhaust valves are not freed of the exhaust gases, as usual, but are constantly surrounded by

(*Continued on page 77*)

Leads the way with New
HEAVY DUTY WRIGHT CYCLONES

41 Additional Wright Cyclones Ordered for New Fleet of Douglas Super Skyliners

TWA has ordered 41 *Advanced* Wright Cyclones to power a fleet of new Douglas Super Skyliners soon to be placed in service on Transcontinental & Western Air—the shortest, fastest route from New York to California.

Three years ago TWA was the first airline to install Douglas Luxury Skyliners—powered exclusively by Wright Cyclones. This new order is a glowing tribute to the reliability and operating efficiency of Wright Cyclones—which have supplied dependable power for TWA to transport many thousands of passengers millions of flight miles in swift, luxurious comfort.

The *Advanced* Wright Cyclones, which will power the new TWA Super Skyliners, are the most powerful single-row, radial engines in the world—capable of producing 1220 h.p. for take-off. These *heavy duty* engines were designed especially for TWA requirements.

When all of the new TWA Douglas Super Skyliners have been placed in service, Transcontinental & Western Air will have a fleet of 50 Cyclone-powered Douglas Skyliners in operation which will fly over a million miles a month, maintaining swift TWA schedules.

"Fly With Wright the World Over"

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

NEW ANTI-STATIC ANTENNAS FOR HIGH-SPEED AIRCRAFT

HENRY W. ROBERTS

● One of the special problems confronting the aeronautical radio engineer is the elimination of a certain type of static almost entirely unknown outside of aircraft operation. Although commonly called "rain static," this can also be caused by snow, sleet, or dust. With the development of the highly sensitive modern radio receivers, the rain static hazard assumed such proportions that several airlines found it necessary to conduct exhaustive research into its nature, and develop new types of antennas which would be impervious to this disturbance.

During the last two years, the radio laboratories of Transcontinental and Western Air and United Air Lines have conducted independent tests with electrostatically shielded loop antennas, and both companies have recently announced that their fleets will be equipped with the new anti-static antennas during this winter.

Rain static is easily distinguishable from the usual thunderstorm intermittent crash type; it takes the form of a fairly steady rumble or squeal in the earphones, and prevents radio reception. It occurs most frequently from January to May, being especially severe during snow and rain squalls. It has been known to affect radio reception for hours, and extend along several hundred miles of an airway.

The electromagnetic field around the United Air Lines' anti-static antenna is free from distortion. Air flow at this point is lowest

Comparatively little is known about the nature of rain static, but investigations made by the two companies have shed much light on the mechanics of its production. It is now known that this disturbance is caused by differently charged particles of rain, snow or dust striking the airplane and constantly building up fluctuating high-potential charges in the antennas and the airplane structure. These particles are constantly flowing off in a non-uniform manner and completely drown out the signals even at a short distance from the station.

Potentials in excess of 25,000 volts are not infrequently built up in aircraft during flight. Under such conditions, well-defined St. Elmo's fire is observed along the airplane structure particularly at the wing tips and other projections. Local discharges have occasionally been found to pierce the rubber de-icers along the leading edges of the wings and the tail surfaces.

Nevertheless, the static observed in the presence of such corona discharges is slight, and probably represents the electromagnetic effect of the corona current flow. Rain static seems to be produced by steady fluctuations in the polarity of the charge, rather than by the magnitude of its potential.

This contention is apparently supported by experiment. The electrical charges carried by the particles vary not only in potential, but also in polarity, and the severity of rain static increases with the speed of the airplane as well as with the number of particles striking the antennas within a given period. It is known that large and small droplets falling in free air are charged differently both as to polarity and potential; a single droplet striking the airplane and ricochetting several times may change its polarity several times as it comes in contact with the airplane. In this manner, an airplane flying through rain, snow, or dust is being constantly subjected to non-uniform electrical charges. These charges, constantly flowing off, produce the phenomenon known as rain static.

The TWA anti-static antenna is used for both audio reception and radio direction finding. It may be rotated from the pilots' compartment

The speed with which the electrically charged particles strike appears to be a major factor. Rain static is unknown on the ground (only comparatively mild manifestations have been observed by ground stations in the Great Lakes district during sleet gales, and in the Southwest during sand and dust storms). In an airplane flying at 180 mph, rain static frequently assumes such proportions that a 400-watt station is completely blanketed at a distance of only 10 miles, and less. A reduction in speed to about 120 mph invariably results in a substantial decrease in static noise. It appears certain that the new and faster airplanes now being placed in service would be subject to this disturbance to an even greater degree, making the adoption of anti-static antennas imperative.

Ordinary static leak arrangements on conventional antenna structures have been found ineffective in eliminating rain static. The solution was found in the use of electrostatically shielded loop antennas.

The TWA loop antenna, 10" in diameter, is mounted under the fuselage slightly ahead of the electrical center of the airplane, directly under the radio compartment. The metal shield structure is aluminum tubing; the gap is about ¼", with a parallel wire shield placed over it, the wires being grounded to the loop structure on one side of the gap.

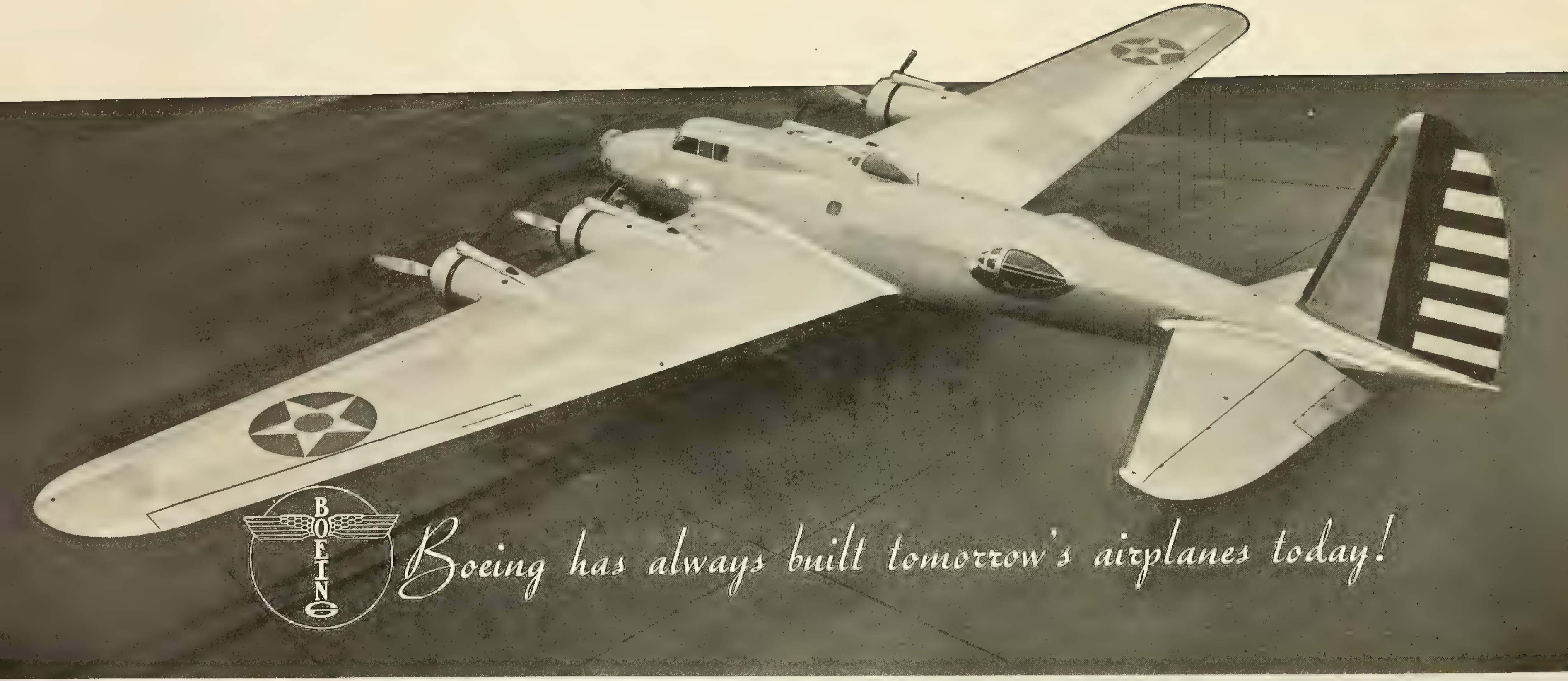
Provision is made for rotating the loop about its axis manually, from the pilots' compartment. For audio reception of signals, the loop is oriented with its plane in the direction of the incoming signal. In this position, the loop is most responsive to the incoming signal, and will provide good audio reception from stations lying within 30° on either side of the course.

(*Continued on page 75*)

NEW WINGS FOR DEFENSE...

★ Pioneering is a Boeing tradition. This is the first of a series of giant four-engined bombers now being built for the United States Army Air Corps, a type of plane which is establishing a new trend in commercial as well as military designs.

The Boeing YB-17



Mollison's Trans-Atlantic Bellanca "Flash" Model 28-70 Monoplane

● Fastest west-east crossing of the Atlantic ocean was made by Capt. James A. Mollison who on Oct. 29 flew his Bellanca Flash *The Dorothy* from Harbor Grace, Newfoundland to Croydon Airport, London in 9 hrs. 15 min., at an average speed of 227 mph for the 2100 miles. Leaving Floyd Bennett Field, New York the previous day, Capt. Mollison stopped at Harbor Grace from where he took off to make the crossing 72 min. ahead of his estimated time and 6 hours faster than the old record.

The Flash is designated model 28-70. It is a low-wing braced monoplane powered by a 700 hp twin-row Pratt & Whitney engine and equipped with a retracting undercarriage. Its 600-gal. fuel capacity gives it a range of 4000 miles at a cruising speed of 240 mph.

Wing construction follows Bellanca standards, being of the braced two-spar type with closely spaced ribs, the whole being fabric covered. Wings taper in plan form and construction and bracing is carried out by a system of tie rods to the fuselage on top and to two steel supporting struts extending below. Position of these tie rods is so disposed as to make space for wheel clearance in the retracted position. Pyle-National landing lights are installed with curved glass set integral with the leading edge of the wing.

Fuselage structure is of welded chrome molybdenum steel tubing, well faired and covered with fabric. From the engine to the rudder it presents the well-streamlined form which increases aerodynamic efficiency. The two-place cockpit, set well aft of the trailing edge of the wing, is provided with a sliding canopy top of *Plexiglass*, a new material which can be worked and bent and which allows light to pass through more freely than standard window glass. Seats are arranged in tandem; there are dual controls and a complete set of flight and engine instruments facing the front and an airspeed indicator, altimeter and magnetic compass facing the rear seat.

Two fuel tanks, one for 480 gals. and the other for 120 gals., complete with dump valve, are forward of the cockpit, the main and larger tank being ahead of the auxiliary tank which is directly forward of the pilot. Tankage also is provided for 42 gals. of oil in a main 34-gal. tank and an 8-gal. auxiliary tank directly beneath.

Landing gear loads are distributed over a triangular truss arrangement, and one leg of the individual type undercarriage incorporates a splined oleo shock absorbing unit on each side. Wing spars at the point of attachment of the landing gear are thick and sturdy to take care of flying and landing loads. Retraction of the wheels is by conventional hydraulic mechanism, the locking arrangement being separate from the retraction devices. Locking is obtained by working an Arens cable control and thrusting a tapered steel pin through a hole in a lug on the landing gear leg. Wheels are of the standard Bendix airplane type and are fitted with 32 × 6 Goodrich tires and equipped with Bendix hydraulic brakes. A full balloon tail wheel, partially enclosed in a streamlined cuff, is provided at the fuselage tail-post.

Tail group of the model 28-70 is noteworthy. The stabilizer is tapered in plan form and is plywood covered, stabilizer adjustment being eliminated through the use of tab controls on the elevators. Elevators are dynamically balanced, and are of chrome molybdenum welded steel tube construction with fabric covering; the rudder is of similar construction. The fin is plywood covered and fairs into the cockpit hood.

Power plant consists of the P. & W. geared 14-cylinder twin-row Wasp Junior engine which develops its 700 hp at 2500 rpm at 9000 ft. The propeller is a two-bladed Hamilton Standard controllable pitch type with a diameter of 10 ft. 6 in. An oil radiator with adjustable scoop opening, controlled by a crank in the pilot's cockpit, is provided. Engine cowling is of the latest NACA type, and consists of a sturdy nose ring and four readily removable segments, attached by Dzus fasteners.

Bellanca is revising the model 28-70 type with particular reference to the forthcoming New York-Paris race. It will be similar to *The Dorothy* in all respects except that it will have a full cantilever wing instead of a braced wing. With the higher horsepower Twin Wasp engine, a top speed in excess of 300 mph, as well as a range of more than 5500 miles, is expected.

Specifications and performances of the 700 hp P. & W. Wasp Junior-powered Bellanca Flash model 28-70 are as follows:

Wing span	46 feet 2 inches
Overall length	26 feet
Overall height	7 feet
Wing area	279 square feet
Empty weight	4074 pounds
Useful load	4276 pounds
Gross weight	8350 pounds
Max. speed (9000 ft.)	275 + mph
Cruising speed	240 miles per hour
Cruising range	4000 miles
Rate of climb	1500 feet per minute
Service ceiling	26,000 feet
Absolute ceiling	27,000 feet

The Bellanca Flash has a range of 4000 miles at a cruising speed of 240 miles an hour

Our Thanks:

TO THE AIRCRAFT INDUSTRY—

for placing in desirable positions 136 graduates of this school during the past year. It is a source of satisfaction to know that the varied and cumulative aeronautical experience of our faculty has been of benefit to our boys (and ultimately to you); that our curriculum has kept pace with the industry's progressive requirements; and that our facilities are adequate to meet any training demand.

TO OUR GRADUATES—

for applying so diligently to your new places in the aviation business the knowledge which you gained here. You worked and studied hard; and we are proud indeed to call you alumni of the Casey Jones School of Aeronautics. You have our sincere wishes for continued success.

CASEY JONES SCHOOL OF AERONAUTICS

534 Broad Street Newark New Jersey

Registrations for 1937 are now being accepted—next classes start as follows:

Aeronautical Engineering—Day (2 year course) March 22, 1937
Aeronautical Engineering—Evening (4 year course) Sept., 1937
Master Mechanics—Day (14 months course) Feb. 15, 1937
Master Mechanics—Evening (28 months course) Jan. 11, 1937

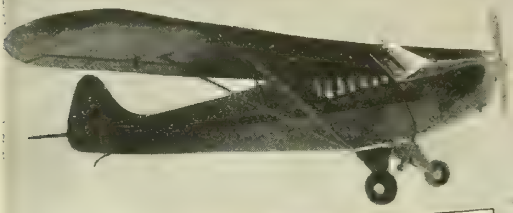
GOODRICH LEADS

How Goodrich — Builder of the world's most universally used airplane tire and more than 40 other aviation products — contributes extra safety, efficiency, comfort to the operation of these planes and many others . . . . . .

HERE are planes representing every activity in aviation — commercial, private and military. No two are exactly alike in size, speed or carrying capacity. Yet all have one factor of safety in common — *they're equipped with dependable Goodrich Aviation Products.*

Many have used Goodrich Airplane Silvertown Tires year in and year out for extra landing safety. Still other Goodrich Products are built integral with the planes themselves — such as the famous Goodrich De-icer Equipment and Goodrich Abrasion Shoes. In fact, you'll find that in practically every part of a plane the more than 40 Goodrich Aviation Products distinctly contribute to make the plane easier and safer to fly and land. Follow the lead of the leading air lines, pilots and plane makers. "Equip with Goodrich." See your nearest Goodrich dealer or write Dept. 626, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information.

DOUGLAS builds these high-speed air giants. Equipped with Goodrich Airplane Silvertown Tires, Goodrich Abrasion Shoes, Gasoline Hose, Radiator Hose, Grommets, Rubber Cements, Airplane Matting and Goodrich Shock Absorber Cord.



TAYLOR "CUB" Safety is one of the biggest reasons for the phenomenal popularity of these low-priced Taylor "Cubs," and the safety of Goodrich Low Pressure Tires and other Goodrich products has been "standard" with Taylor for over nine years.

BOEING These 3-mile-a-minute Boeings, besides having the "cushioned safety" of Goodrich Airplane Silvertowns, are also equipped with Goodrich De-icers, Gasoline Hose, Shock Cord, Rubber Cements, Grommets and Goodrich Abrasion Shoes.

WACO *Inside and out* this popular Waco C-6 is protected by dependable Goodrich Aviation Equipment. In addition to having Goodrich Low Pressure Silvertowns for extra landing safety, Wacos are built with Goodrich Channel Rubber, Grommets, Rubber Cement, Sponge Rubber and Gasoline Hose.

GRUMMAN To meet rigorous military requirements, this Grumman J F-1 Amphibian is ruggedly equipped — not only with Goodrich Airplane Silvertowns but with Goodrich Tail Wheels, Shock Cord, Grommets and Goodrich Hook Bumpers.

THE AIR PARADE

REARWIN "SPEEDSTER" These sleek, graceful Rearwins are winning new users every day by their low first cost and economical operation. And Goodrich equipment means extra safety and comfort for Rearwin owners and pilots.

MARTIN The Glenn L. Martin Co.—designers and builders of the famous "China Clipper"—again chose Goodrich for this history-making plane. The "Clippers" have Goodrich Rubber Gaskets; Sponge Rubber Strips, Seals, Pads; Sponge Rubber with Fabric Backing; Rubber Cements; Live Rubber Strips; Rubber Bushings; Grommets; Gasoline Hose; Airplane Matting, and Goodrich Tires for Beaching Gear.

BEECHCRAFT A speedy, snappy performer, the Beechcraft C–17–L is "safety-equipped" with Goodrich Low Pressure Silvertown Tires, Goodrich Gasoline Hose, Rubber Tubing and Rubber Cements.

CONSOLIDATED Consolidated Aircraft Corporation is proud of the XPBY-1, the most powerful amphibian fighter to leave its production lines. Equipped with Goodrich Rubber Washers, Grommets, Felt-lined Rubber Channels, Duprene Hose Connections, Pyramid Matting, Vulcalock Cement and Airplane Gasoline Hose.

FAIRCHILD made aviation news with its successful application of the fast "low-wing" design to private transports. This new Fairchild "45" has Goodrich Low Pressure Tires, Goodrich Channel Rubber, Grommets, Rubber Cements, Sponge Rubber, Gasoline Hose, Ventilator Hose and Rubber Shock Discs.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

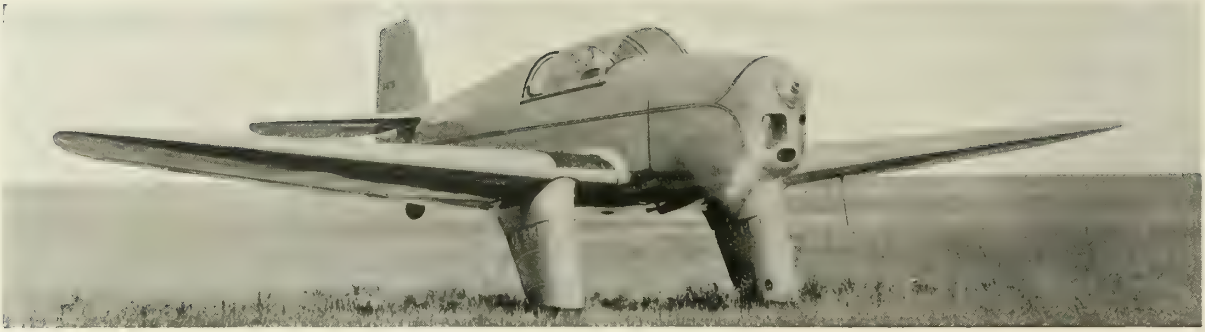
CURTISS Shown above is a high-performance, twin-engined military plane recently built by Curtiss. These Curtiss planes are built with many Goodrich products including Goodrich De-icers. These products are chosen because they measure up to the high standard of dependability demanded by Curtiss.

Goodrich Airplane Silvertowns are built on the low pressure principle for greater safety and smoothness on every landing and take-off. Whether you build planes or fly them, "Silvertown landings" are a distinct business asset.

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.



Ben Jones Sport Plane

● Model S-125 has been designed and manufactured with particular appeal to the average private pilot by Ben Jones, Inc., now operating at the Schenectady, (N. Y.) County Airport. Utilizing simple design, and wood and metal construction, this company has produced a comfortable and appealing machine which it believes best suited for present-day quantity production.

The fuselage is of typical tubular frame construction with metal fairing extending from the soundproofed firewall back to the trailing edge of the wing, and fabric covering from there back. The metal covering at the front of the fuselage is removable. Seats are arranged in tandem with the interior of the cockpit finished in leather and trimmed with welting. Chairs are provided with back cushions and arm-rests are included for both front and rear cockpits. Instruments are on the rear panel which has provision for a radio control installation. Space is provided for a set of duplicate instruments in the front cockpit. Visual fuel gauges are placed on either side of the fuselage just below the pilot's knee, and on the right in the rear cockpit are the shut-off valve, wabble pump and strainer valve. On the same side is the parking brake.

Dual controls are provided. The control stick is pivoted on a post fixed to the aileron torque tube which is mounted in ball bearings which also have been used in other controls and hinges throughout. Sticks are interconnected by a push-pull tube passing through the torque tube.

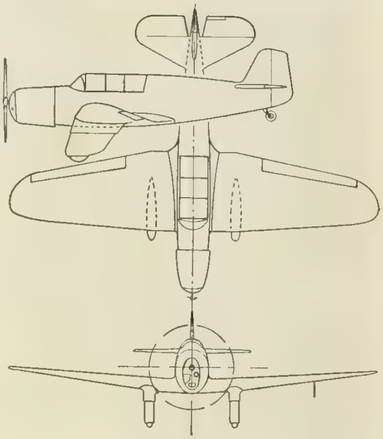
Rudder pedals are pivoted below the floor and are provided with brake control pedals on the outer side. The arrangement is such that either brake may be operated individually or collectively, with or without use of the rudder pedals. Brake control pedals are rubber padded.

The canopy top is built in three telescoping sections, reinforced. Ample space is provided for baggage to the rear of the pilot, access to the compartment being available from the cockpit. Additional pockets are under arm rests.

Wing construction follows standard two box spar design with covering of plywood and fabric. Modified Frieze-type ailerons are cable controlled to bell cranks and push-pull rods operating through rocker arms. Two 23-gal. fuel tanks are carried in each wing on either side of the fuselage and these may be removed through the bottom of the wing.

Tail surfaces are full cantilever with the stabilizer and fin being of all-wood construction utilizing wood spars, plywood ribs and plywood and fabric covering. Elevators and rudder are of dural frame structure with fabric covering, the former being interconnected at the midpoint and operated from that point of connection. A trim tab on the left elevator is operated by a heavy gauge housed wire which passes through the center line of the elevator hinge.

Powered with a 150 hp Menasco engine, the Jones S-125 has a speed of 162 mph



Landing gear is of the cantilever type with individual legs, each completely faired. The gear consists of a fork fixed to a shock strut which is braced and guided by a tripod fixed to the front spar and a tubular truss between the spars. The wheel with brake and axle is easily fixed to the fork axle terminals which are U shaped. Torque from the unsymmetrical wheel loads is transferred by the fork to the tripod by a sliding tube which interconnects the two units. The 8-in. tail wheel has a 360° swivel and incorporates a steel coil shock spring and pneumatic damper for rebound.

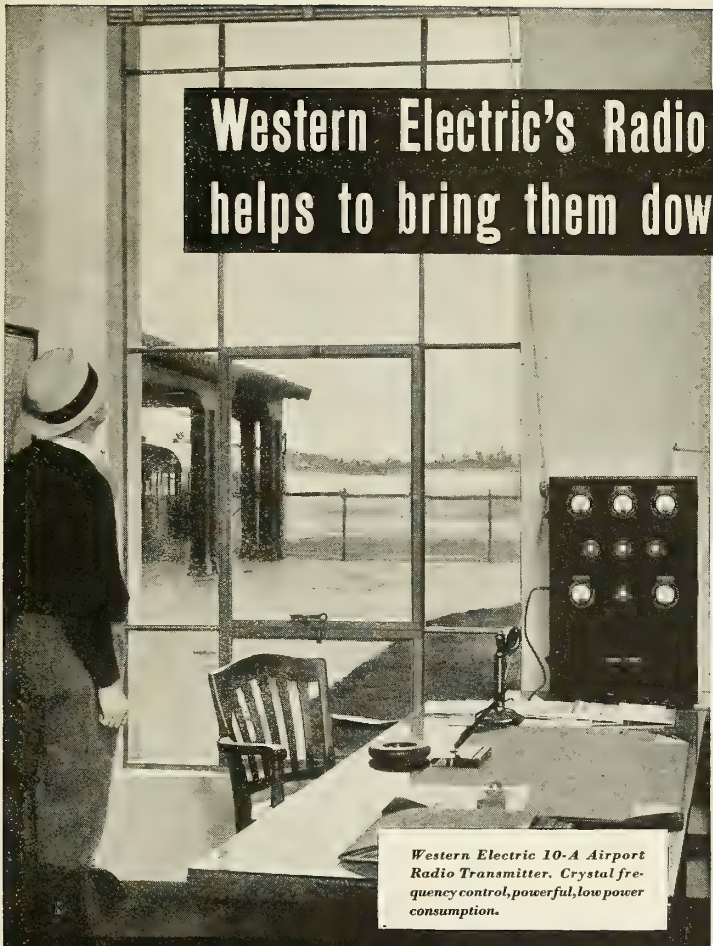
Engine mounting is in rubber and is detachable and a venturi type cowl is utilized.

Specifications and normal load performances of the Model S-125 with the 125 hp and 150 hp Menasco engines are as follows:

Wing span	31 feet
Overall length	24 feet 2 inches
Overall height	7 feet 3 inches
Wing area	140.5 square feet
Empty weight	1125 pounds
Useful load	875 pounds
Gross weight	2000 pounds

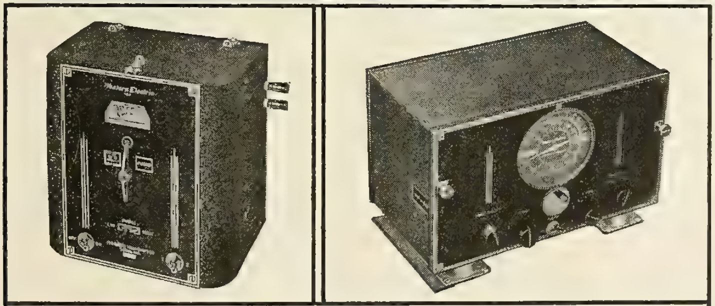
	Menasco C4	Menasco C4S
Horsepower	125	150
Maximum speed (mph)	151	162
Cruising speed (mph)	136	146
Landing speed (mph)	46	46
Take off run (ft.)	390	360
Rate of climb (ft./min.)	1020	1410
Cruising range (mi.)	730	680
Service ceiling (ft.)	14,100	18,200

Western Electric's Radio Telephone Equipment helps to bring them down SAFE...on TIME!



Western Electric 10-A Airport Radio Transmitter. Crystal frequency control, powerful, low power consumption.

Most of the nation's radio telephone equipped private planes use Western Electric



19 type Transmitter and 20 type Receiver for private planes. Smaller than the transport equipment but just as reliable and easy to maintain.

Major Airlines, flying more than 50 million miles a year use Western Electric Radio

NIGHT or day, in stormy weather or clear, Western Electric Radio Telephone equipment plays this important part in air transportation. It supplies vital knowledge, helps keep air travel on an efficient, scheduled basis.

Pilots whose planes are Western Electric equipped know what conditions lie before them. They select their course, altitude and landing field accordingly, thus avoiding delays and forced landings.

Western Electric Radio Telephone equipment—made by the makers of the nation's telephones—has been designed especially to meet the conditions peculiar to aviation. Dependability and simplicity of operation are its outstanding characteristics. That's why it's used by most of the country's leading airlines and by most radio-equipped private planes.

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Digest of Technical Articles from Foreign Publications

Military Design

Will High Speeds Obsolete Pursuit Aircraft? (Les Grandes Vitesses vont-elles Tuer la Chasse? La fermeture de la chasse, A. Odier. Problème de la supériorite balistique du tir en retraite, R. Garnier, Revue de l'Armee de l'Air, No. 86; *Septembre* 1936)

M. Odier advances the maxim that aerial combat is a thing of the past because "it has been and it always will be that, given equality in arms, he who retreats kills the pursuer (parce que c'est et ce sera toujours, à armes égales, celui qui fuit tue l'autre). The author does not believe in pursuit aviation and generally appears to regard as hopeless the problem of aerial offensives. R. Garnier mathematically amplifies Odier's contention of ballistic superiority of retreating aircraft, showing the effects of high speeds and advantages of early fire. Although brief, the article is important in its implications.

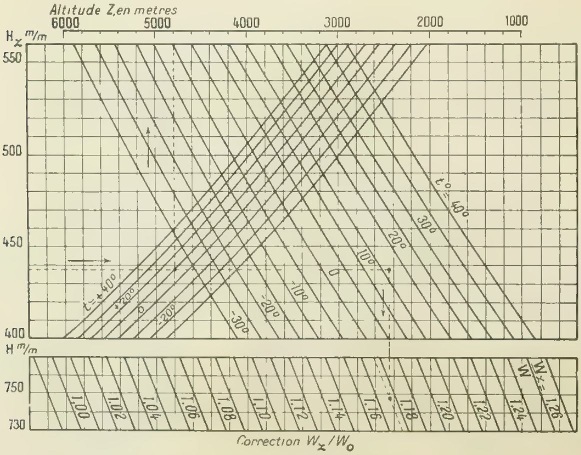
Today's Problem of Pursuit Aircraft (Il Problema della Caccia d'Oggi; Ten. Col Pilota Antonino Serra; Rivista Aeronautica, No. 9; *Septembre* 1936)

An analysis of the widened possibilities of the modern bomber leads the author to some interesting conclusions. The high performance and defensive power of bombardment aircraft place such demands on any offensive or defensive unit that as yet no single type can meet the specifications. The article proposes to subdivide pursuit aircraft into two types: light highly maneuverable interceptor, and larger heavily armed three seater pursuit. It is stated that strict interpretation of pursuit aviation as composed of single engined single seaters must be revised and that in the light of recent experience at least twin-engined aircraft must be considered.

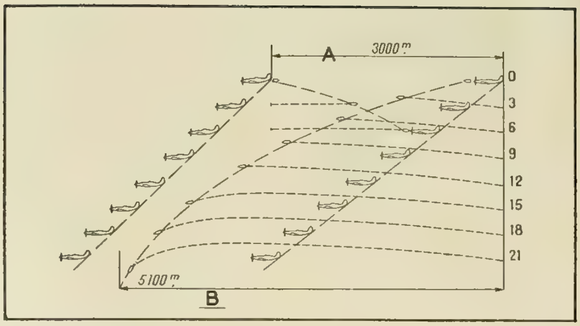
Engines

Horsepower Correction of Supercharged Engines (Correction de Puissance dans les Moteurs à Compresseur; Michel Prècoul; L'Aeronautique, No. 208; *Septembre* 1936).

In many instances the power of supercharged engines at altitude is determined from dynamometer tests in which only the intake pressure condition is simulated. Since this method does not take into consideration the actual exhaust condition, nor the variation in temperatures, certain corrections should be applied to determine true power at altitude. After reviewing the variation of atmospheric constants and normal power decrease with altitude, the author discusses existing methods for power correction of supercharged engines. He gives French, British and Russian formulas as well as a number of charts. It appears that the French have the simplest formula—one which gives power correction as a function of pressures and temperatures corresponding to the tests and the desired altitude.



Horsepower correction of supercharged engines. W_x = power at altitude; W = power from test at sea level. (From L'Aéronautique)



Relative position of two planes and first two exchanges (against time). A—Time in seconds. B—Speed of the pursuit charge = speed of retreating aircraft. (From Revue de L'Armée de L'Air)

Aerodynamics

Measurements of Profile Drag by the Pitot Traverse Method; Cambridge University Aeronautics Laboratory; Air Ministry (Great Britain); Aeronautical Research Committee Reports and Memoranda No. 1688; *January,* 1936

To improve performance of airplanes it is important to be able to measure the drag of their component parts while in actual flight. Direct measurements of drag force are difficult, but there is an indirect method which involves merely the examination of the "wake" left behind in the air by the component part under consideration. After examining the theoretical aspects of this problem the report gives an account of an experimental study of the method in a wind tunnel and of applications to a wing of an airplane in flight. The method provides an easy and satisfactory way of determining, in flight, the local profile drag coefficient for any given portion of the wing. It enables variation of drag due to changes of surface condition to be determined within approximately 2% of the profile drag.

Two series of flight experiments were made, one with standard fabric wing covering and the other with smooth polished wing surfaces.

With Reynolds Number about 5,000,000, the profile drag coefficient of a smooth wing of 10.5% thickness chord ratio and 2% center line camber was found to be 0.0069, as compared with a mean value of 0.0090 for a fabric covered wing of substantially the same section.

The Problem of Resistance in Compressible Fluids (Il Problema della Resistenza nei Fluidi Compressibili; Th. von Karman; L'Aerotecnica, Vol. XVI-No. 8-9; *Agosto-Settebre* 1936)

This article is the Italian translation of the paper presented by Dr. Karman at the Fifth Volta Meeting (1935) held in Rome. The contents covers the following aspects: thermodynamical relationship; mechanical similitude; general analyses of resistance; compressibility effects on frictional resistance, for potential flow around an obstacle at subzonic speeds, and on wake resistance at subzonic speeds; approximate theory of wave resistance for a two-dimensional flow; shock waves and a second approximation for a superzonic two-dimensional flow around an obstacle; approximate theory of wave resistance for elongated bodies at rotation; and precise equation for a flow with axial symmetry. In addition, the contents covered other three-dimensional problems, discussion of experimental results in superzonic fields, and the limiting case of high speeds in relation to the speed of sound.

Structures

Formulas and Methods of Calculations of the Strength of Plate and Shell Structures in Aeroplane Construction; O. S. Hech and H. Ebner; The Journal of the Royal Aeronautical Society, Vol. XL, No. 310; *October* 1936.

Not the least important part of a technical paper is an ample bibliography. This paper, in addition to giving in concise and directly applicable form, numerous structural formulas for flat and curved shell, must be particularly recommended because of the extensive list of references. Problems covered include: strength of rectangular plates; isotropic plates (pressure stress, behavior after buckling, shearing stress); orthotropic plates; plates with stiffeners; sheet metal girder with parallel flanges and vertical web members; sheet metal girder with non-parallel rigid flanges; strength of circular cylindrical partial shells; partial shells with stiffeners; strength of circular cylindrical solid shells; isotropic solid shells; orthotropic shells; and solid shells with stiffeners. There are 113 references given in the paper.

(Continued on following page)

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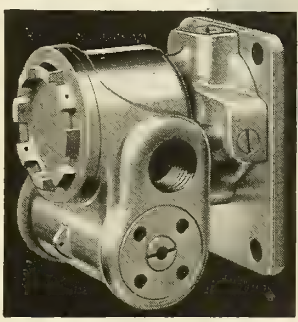

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(*Continued from preceding page*)

Aerodynamics

General Considerations Relating to Flow of Compressible Fluids (Considerazioni Generali sulla Corrente dei Fluidi Compressibili, Prandtl, L'Aerotecnica, Volume XVI, No. 7, Luglio 1936.

The present article is a translation into Italian of the paper presented by Dr. Prandtl at the Fifth Volta Meeting held in 1935. The physico-mathematical difficulties of the problem make it essential to resort to certain basic simplifications. The fluid is assumed to possess only the qualities of ideal fluids except that it is considered compressible. Its density is assumed to vary with the pressure, the heat transfer being neglected. The fact that it is assumed to be frictionless makes Lagrange's theorem valid, i.e. an irrotational flow remains irrotational. Prandtl reviews subzonic speeds pointing out that locally in cases of many sections and particularly in the case of wings such flows become locally superzonic. He then analyzes the condition of uniplanar flow and approximations required for the condition of speeds beyond that of sound. The last chapter is devoted to the application of the theory to wings. The fact is stressed that while in subzonic region the induced drag still follows the usual law at superzonic speeds this law is invalid. The resistance becomes considerably greater due to compression waves (compressibility burble) while the induced drag is mostly due to the marginal shock waves which in a rectangular wing are entirely contained within Mach's angle. According to Busemann the usual induced drag disappears with the formation of the two triangular wing portion within shock wave angle.

Flight Tests of an Atlas Fitted With Autoslots Having Various Link Arrangements. By W. G. Jennings, B.Sc. Communicated by the Director of Scientific Research, Air Ministry (Great Britain); Aeronautical Research Committee, Reports and Memoranda No. 1677, *March,* 1932.

There has been some difference of practice in the design of the link mechanisms of automatic wing tip slots. One method is based on the provision of an adequately convergent slot passage from entrance to exist for all partial openings of the slot. In this arrangement the slot commences to open at a low angle of attack and then continues to open progressively as the airspeed is reduced. In another design the opening of the slot is delayed to a low speed and then the opening occurs suddenly. These two methods of design lead to somewhat different positions of the slot in the fully open position and the two arrangements were compared by flight tests.

Flight tests were conducted with four types of auto-slot linkages fitted to an Atlas, including the "convergent passage" type; "delayed opening" type; standard, and standard (modified).

When fully stalled the aircraft behaves much the same when fitted with any of the above types of autoslot. Stability is good, but control is ineffective. The "delayed opening" type is advantageous in that the slot is kept closed at all speeds above climbing speed but the correct amount of delay required to give satisfactory results is somewhat critical. In normal flight the lateral control of the aircraft deteriorates markedly between 60 and 70 mph. This lack of control is independent of the autoslot and occurs in the unslotted aircraft to the same degree.

The Effect of Weight on Take-off and Landing. E. Finn, B.Sc. and S. P. Osborne, B.Sc. Air Ministry (Great Britain). Aeronautical Research Committee Reports and Memoranda No. 1682, *October* 16, 1935.

Tests have been carried out to provide data for assistance in estimating the effects of differences in weight on the flight path of an aircraft from rest to a barrier height of 50 ft. or more.

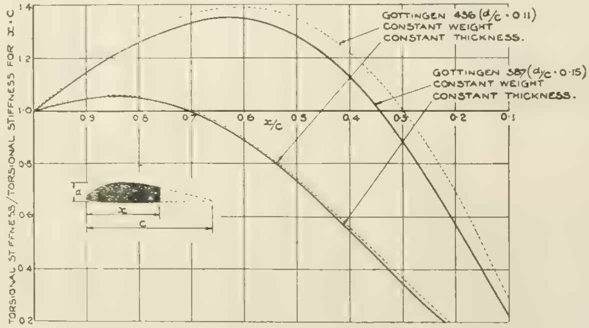
Panoramic photographs of a *Vildebeest* taking off and landing were obtained at total weight of 5674, 7340 and 8200 lbs. The distances to take-off and landing were obtained from the photographs and correction factors deduced for change of weight.

The following conclusions have been drawn: (1) The take-off run is directly proportional to the ratio of the all up weights raised to a power 2.33, the result which agrees well with that obtained previously 1; (2) Take-off occurs at the same value of lift coefficient for each weight; (3) With certain assumptions, a method of calculating the air-borne take-off flight path is suggested; this can be extended to give a method of correcting the flight path for weight; (4) The landing run is directly proportional to the weight; (5) Landing occurs at the same value of lift coefficient for each weight; and (6) The air-borne landing flight path appears to be unaltered by change of weight.

Propellers

Variable Pitch Propellers. (L'Elica a Passo Variable, Tenente G.A.R.I., Andrea Bellonio. Revista Aeronautica, No. 8, *Agosto,* 1936.)

After a brief and non-technical discussion of the desirability of controllable pitch propellers, the author then explains and defines the possible types of fixed, adjustable and controllable pitch propellers. He then describes some of the existing propellers including the Ratier, multi-pitch, automatically variable; the Ratier, multi-pitch, electrical control, feathering blades; the Ratier, multi-pitch, electrical control (type developed for French stratospheric project *Guerchais*); the Breda-Ratier, two-pitch, spring and counterweight action; the Hamilton Standard, two-pitch oil and counterweight action; the Hamilton Standard, multi-pitch, constant speed, oil, counterweight and governors action; the Gnome-Rhône, multi-pitch, mechanical manual control; the Eclipse, multi-pitch, automatic, spring action; the Levasseur, multi-pitch, automatic, spring and centrifugal force action; the Levasseur, three-pitch, automatic, spring and centrifugal force action; the Savoia-Marchetti, two-pitch, controllable, mechanical-oil action; the Alfa Romeo-DeCaria, multi-pitch, electro-mechanical pilot's control; the Piaggio-D'Ascanio, multi-pitch, utilizing propeller's shaft rotation as actuating motion and pilot's mechanical control; and the Gloster Hele-Shaw Beacham, multi-pitch, controllable, oil action.



The relative variation of torsional stiffness of a stressed skin type of construction (From Aircraft Engineering)

Structures

On the Stressing of Aeroplane Wings Due to Symmetrical Gusts. L. W. Bryant, A.R.C.Sc., and I. M. W. Jones, Aerodynamics Department, N.P.L. Air Ministry, (Great Britain) Aeronautical Research Committee Reports and Memoranda No. 1690 *February* 15, 1936.

Based on the simplest hypothesis of the instantaneous adjustment of circulation around a wing to sudden change of incidence and speed, it is known that the greatest load due to a gust of given magnitude symmetrically disposed with respect to the airplane occurs when the gust is inclined at about 70° to the line of flight. The effect of a vertical gust, however, does not differ from the maximum by as much as 10%. On the same hypothesis, neglecting wing elasticity, airplane stability and other relevant factors, it can be shown that the load due to a gust of 70° inclination would depend only on the ratio of airplane speed to gust speed and on the magnitude of $\frac{1}{2}C_L$ for steady horizontal flight. It is clear that a given gust will have greater effects on slow-speed, lightly-loaded craft. Heavily loaded aircraft in steep high velocity dives may experience trouble due to horizontal gusts, especially if the gust produces a down load which the structure may not be designed to withstand. The purpose of this report, however, is a study of the effect of two important factors which modify considerably the loading as calculated on the simple "sharp-edge" hypothesis for vertical gusts.

Stiffness of Thin Shells; Brief Notes on the Optimum Stiffness Obtainable for a Given Weight of Material, H. Roxbee Cox, Ph. D., F.R.Ae.S. Aircraft Engineering, Vol. VIII, No. 91, September, 1936.

Discussing the stiffness of thin shells the author arrives at the following conclusions: (1) Using skin stressed covering for the wings and extending such covering completely around the perimeter may not give maximum economy: (2) For any thin walled cylindrical shell the greatest stiffness for a given weight is obtained when the wall thickness of the material does not vary round the perimeter of the cross-section; (3) For a shell of constant cross-sectional outline, held at one end like a wing, it is proved that the greatest stiffness for a given weight of material is obtained when the wall thickness varies along the length directly with the integral from the free end of the applied torque. For a couple at the tip this means constant thickness throughout the wing.

Dear Son:

This year Mother and I are saying "Merry Christmas" with the one present that will bring you happiness throughout your life. To us it means more than just the joy of giving—this course in the Spartan School of Aeronautics we feel will give you the proper training to fit you for your opportunity in one of America's fastest growing Industries—Aviation! At Spartan we will have the confidence of knowing that in the Dawn Patrol you will associate with the finest youth of the world—young men; like yourself who will be studying in enjoyable surroundings, with instructors and equipment that has made Spartan an outstanding name in Aviation Instruction. This Christmas will be a happy one for us all in the realization that at Spartan with the Dawn Patrol we are providing you the opportunity for a successful future.

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Recent Aeronautical Patents

● The following recent patents of interest to readers of AERO DIGEST were compiled from the Official Gazette of the United States Patent Office.

Parachute assembly. Samuel H. Knight, Lancaster, Pa. (2,053,342)

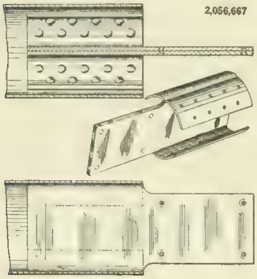
Safety chair for airplanes. Albert B. Scott and Edmund Goulding, Los Angeles, Calif. (2,053,538)

Automatic starter for motors. Georges Roes, Paris, France. (2,053,634)

Propeller blade. Ewald F. Techmer, Chicago, Ill., assignor by direct and mesne assignments to William E. Bucholz as trustee. (2,053,851)

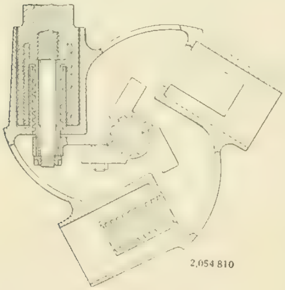
Internal combustion engine. Harry L. McPherson, Memphis, Tenn. (2,054,133)

Tubular structural members for tubes. Arthur Gouge, Rochester, England, assignor to Short Brothers (Rochester & Bedford) Ltd., Rochester, England. (2,056,667)



Airplane. Vito Loreto Volpicelli, Scranton, Pa. (2,054,610)

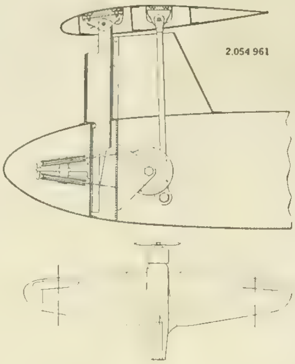
Adjustable pitch propeller. Achille Ernest Gaba, Paris, France. (2,054,810)



Directional receiver. August Leib, Berlin, Germany, assignor to Telefunken Gesellschaft fur Drahtlose Telegraphie m.b.H. (2,054,160)

Double window construction. John H. Fox, Pittsburgh, and Charles E. Stroud, Ford City, Pa., assignors to Pittsburgh Plate Glass Co. (2,054,856)

Lateral control system for aircraft. Edmund T. Allen, Encinitas, Arthur L. Klein, Los Angeles, Clark B. Millikan, Pasadena and John K. Northrop, Glendale, Calif., assignors to the Northrop Corp. (2,054,961)



Automatic variable pitch propeller. Zelie Riddle, San Diego, Calif. (2,054,947)

Cooling system. Harold Caminez and Norman H. Gilman, Indianapolis, Ind., assignors to General Motors Corp. (2,054,926)

Remote control system. Robert H. Nisbet, Osterley, England, assignor to Sperry Gyroscope Co., Inc. (2,054,945)

Aircraft propelling mechanism. Albert R. Jacobs, Reiffton, Pa. (2,055,081)

Astronomical instrument. Frederick H. Hagner, San Antonio, Tex., assignor to Position Finder Corp. (2,055,148)

Oleo gear. John R. Cautley, South Bend, Ind., assignor to Bendix Aviation Corp. (2,055,248)

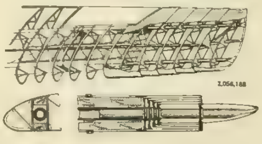
Two cycle single sleeve-valve engine. Benjamin Kahn, New York, N. Y. (2,055,352)

Landing indicator for airports. Arthur M. Wilhelm, Randolph, N. Y. (2,055,370)

Brake for landing gear wheels of airplanes. Alfred H. Hofer, Dayton, Ohio., assignor to Bendix Brake Co., Chicago, Ill. (Reissue 20,126)

Power Plant. Robert E. Lasley, Waukegan, Ill. (2,056,198)

Aircraft wing construction. Kenneth L. Hayden, Winthrop, Mass. (2,056,188)



Automatic Signal Receiving System. Percival D. Lowell, Chevy Chase, Md. (2,056,200)

System of and Apparatus for Observation and for Range and Position Finding. Richard H. Somers, U. S. Army, Mickleton, N. J., James L. Guon, U. S. Army, Kansas City, Mo., and James C. Karnes, Buffalo, N. Y. (2,056,216)

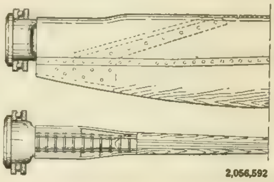
Wire Connector. Stephen N. Buchanan, Elizabeth, N. J., assignor to The Thomas & Betts Co., Elizabeth, N. J. (2,056,248)

Tail Flaw Detector Mechanism. Walter M. Perry, Brooklyn, N. Y., assignor to Sperry Products, Inc, Brooklyn, N. Y. (2,056,291)

Control System. Martin A. Edwards, Schenectady, N. Y., assignor to General Electric Company. (2,056,348)

Rate of climb indicator. Erhard Horn, Leipzig, Germany. (2,056,354)

Airscrew. John Davenport, Sidley and Hamilton Neil Wylie, Coventry, England, assignors to Sir W. G. Armstrong Whitworth Aircraft, Ltd., Whitley, Coventry, England. (2,056,592)



Multicylinder reciprocating piston machine. Charles Schaer, Winterthur, Switzerland, assignor to Sulzer Frères Societe Anonyme, Winterthur, Switzerland. (2,056,622)

Engine starter. Raymond P. Lansing, Montclair, N. J., assignor by mesne assignments to Eclipse Aviation Corp. (2,054,381)

Engine starting mechanism. Romeo M. Nardone, E. Orange, N. J., assignor to Eclipse Aviation Corp. (2,054,387)

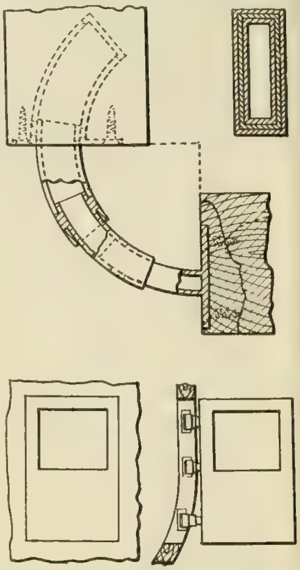
Lock nut and method of making. William E. Sharp, deceased, by Minnie E. Sharp, executrix, Chicago, Ill. (2,054,393)

Fastener handle. William Dzus, West Islip, N. Y. (2,054,519)

Method of installing sound absorbing material. Stephen J. Zand, Forest Hills, N. Y., assignor to Sperry Gyroscope Co., Inc. (2,054,531)

Explosionproof Shielded Spark Plug. Hector Rabezzana, Flint, Mich., assignor to General Motors Corp., Detroit, Mich. (2,056,739)

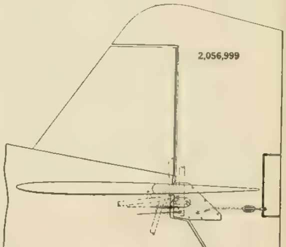
Concealed hinge. Harry F. Reichard, Columbus, Ohio. (2,056,805)

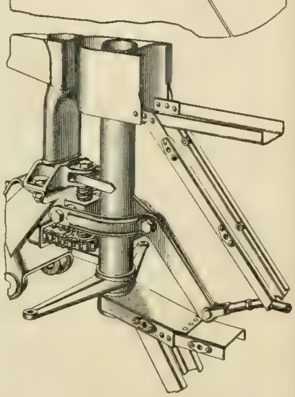


Flux Distributing Insulator. Edward C. Vrooman, Schenectady, N. Y., assignor to Locke Insulator Corporation, Baltimore, Md. (2,056,813)

Engine mount. Corydon M. Johnson, Freeport, N. Y. (2,056,938)

Control mechanism. Raymond C. Blaylock, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Corp. (2,056,999)





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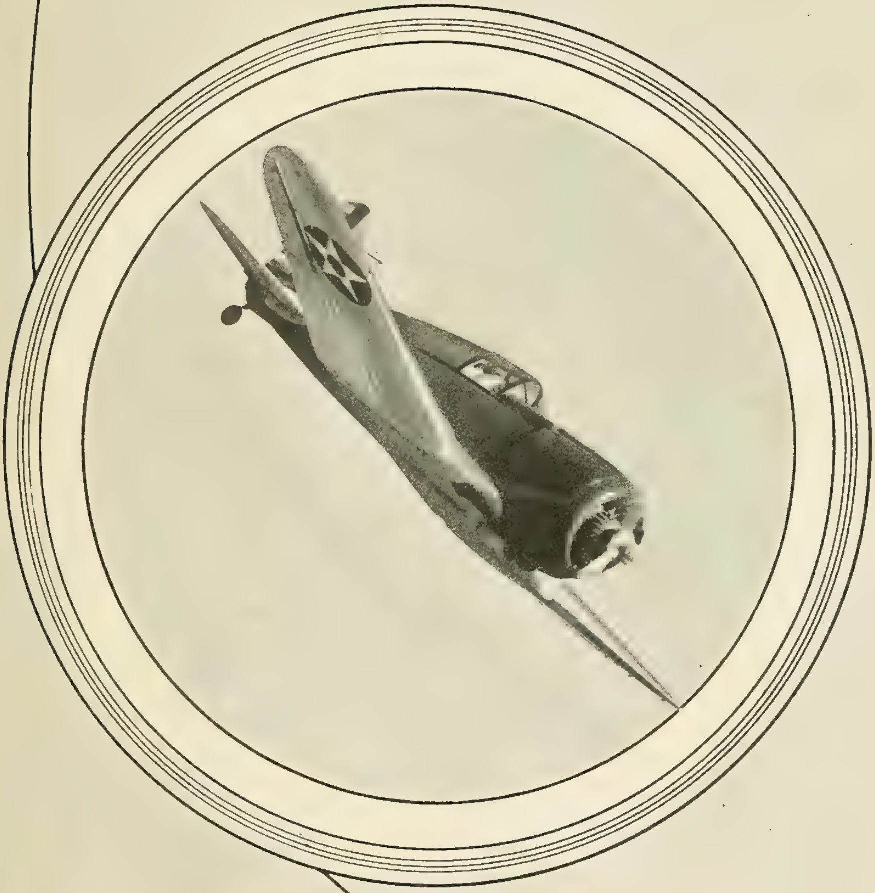

New and modern in design, outstanding in performance, this first all-metal Vought single-seat fighter carries on the traditions that have made the two-seat Vought Corsairs famous all over the world.

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First Place Winner in the 1936 Continental Aircraft Design Competition

● First place in the 1936 Continental Aircraft Design Competition was awarded to LaVerne R. Biasell, of the Aeronautical Engineering School of the University of Detroit. This competition, sponsored by Continental Motors Corp., and open to Junior aeronautical engineering students at the University, offers annually an appropriate trophy to the student who, in the opinion of the judges, has produced the best design of an airplane as part of his Junior courses in airplane design. Each design is judged on its general arrangement, originality, neatness and how well it accomplishes the purposes for which it was intended. Design work is carried on at the University under the direction of Prof. Peter Altman.

Judges this year were Allan Dallas, Stinson Aircraft Corp.; M. A. Mills, Stout Engineering Laboratories; Lieut. Glenn G. Price, U. S. Navy Reserve (Grosse Isle Base); Frank Spring, sportsman pilot; and Norman N. Tilley, Continental Motors Corp.

The winning design, known as the *Titan,* had the unanimous approval of the judges and was marked with a perfect score. It is a two-place high wing monoplane powered by a Continental A-40 engine, and presents exceptionally clean lines and a number of interesting and novel features.

Second place in the competition went to Frank Bowers, Jr., with a mark of 85 on a two-place small horsepower monoplane while Jule Pauken was third with a mark of 77.5 for a design of a twin engined six-place low wing monoplane.

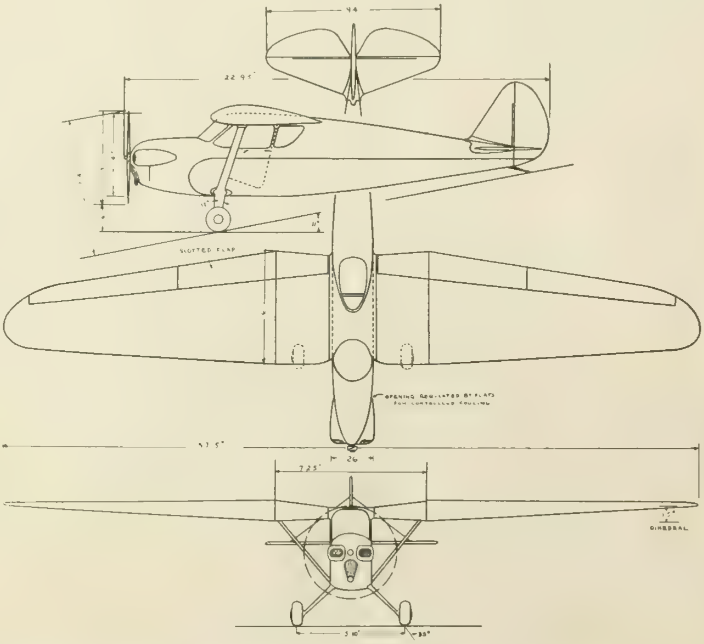
The design of the *Titan* is intended to appeal to the private flier who desires a low price airplane whose performance and ruggedness adapts it for training and sport purposes. Weighing 583 lbs. empty and 1003 lbs. loaded, it incorporates features found in higher priced airplanes and yet its operating and maintenance costs are those of a small, light craft.

A semi-cantilever type plane with an overall length of 22 ft. 9.5 in., and a height of 6 ft. 6 in., the *Titan* design provides for a cabin arrangement with two seats placed in tandem, and provision for 15 lbs. of baggage. External appearance is of clean design and has a minimum number of struts and wires. The semi-cantilever wing, which has a span of 37 ft. 5 in., and a 174 sq. ft. area, is of monospar construction, the single spar being made up of mild steel tubing to facilitate maintenance and repair. Drag bracing on the back of the spar supports a dummy spar, on which are hinged the ailerons and slotted type flaps. The single strut attaches to the wing at a point 3 ft. from the fuselage and the wing has a reverse taper from this point, this reduction of a wing section improving visibility at all flight altitudes.

Visibility from either seat is enhanced by a unique method of damping out engine torque. Rather than eliminate torque by a truss extending through the windshield, this is accomplished by a member placed aft of the pilot. This member is in the form of a truss placed crosswise in the fuselage and in addition to damping out torque, it provides a means of transferring the landing load directly to the wing.

Cooling air is discharged back of the cowl through vents, which are flapped to allow temperature control. A similar arrangement is made for passing the air over the crankcase.

Powered by the Continental A-40 engine which develops 37 hp. the *Titan's* designed performance calls for a maximum speed of 96 mph, cruising speed of 86 mph, stalling speed of 35 mph and a cruising range of 275 miles. Tankage for 10 gals. of fuel and 1 gal. of oil is provided, and fuel consumption is 3.75 gals./hr.



Three-view drawing of the winning design, by L. R. Biasell of the Univ. of Detroit

BOEING SCHOOL'S 12-Month "AIRLINE MECHANIC" course covers 39 SUBJECTS

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In the "Airline Mechanic"—one of 5 ground courses—you cover *theory* in classrooms and laboratories; practical work in 7 modern shops: Radio, Maintenance, Power Plants, Woodworking, Welding & Metals, Fabrication & Design, and Instruments. You become familiar with industry practice through actual hangar service at Boeing School.

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☐ Airline Operations
☐ Aircraft Sheet Metal
☐ Airline Technician (For engineering graduates only)
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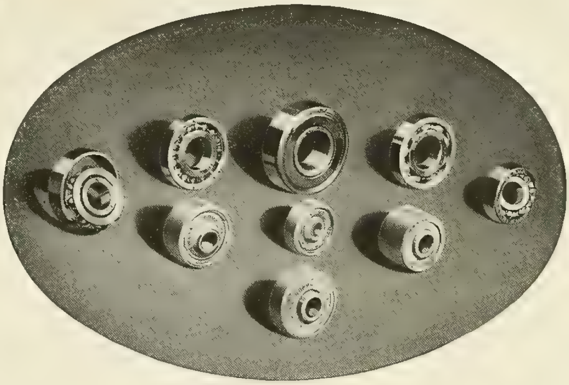
☐ Home Study Courses (For those in the industry)

*Name*__________ *Age*__________
*Years in High School*__________ *Years in College*__________
*Address*__________ *Phone*__________
*City*__________ *State*__________

For AIRCRAFT CONTROLS



A quarter-century of pioneer experience is represented in the PRECISION Control Bearings pictured here. Throughout that period, NORMA-HOFFMANN Bearings have been an important factor in aircraft construction, and have been identified with practically all of the history-making achievements in distance, speed and endurance flights.

NORMA-HOFFMANN engineers have developed many of the distinctive bearing types now accepted standards in aviation practice. And NORMA-HOFFMANN PRECISION Bearings are today used by practically all representative builders in many vital applications in aircraft and equipment.

The PRECISION line of 108 distinct series includes—besides control bearings—PRECISION units adapted for practically every aviation requirement, in planes, engines and accessories. Write for the Catalog and special Aircraft Bearing Bulletin. Let our engineers work with you.

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STAMFORD, CONN., U. S. A.

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EQUIPMENT and METHODS

Aircraft Battery

Designed for aircraft service, type R-1213G Prest-O-Lite battery has been engineered to pack a maximum of electrical power into a unit of minimum weight and size. This battery delivers 12 volts; 105 amp. hrs. at the 5-hr. rate, or 150 amps. at the 20-min. rate. It will maintain a 450 amp. discharge for five minutes (at 80° F.) to an end voltage of 1.2 volts per cell. There are 13 plates to each cell and overall dimensions are: length 14.06"; height 10.87"; and width 7.25". Net weight, filled, is 91 lbs.

High capacity-to-weight ratio (1.15 amp. hrs./lb.) is obtained by a new method of passing the cell connectors through the cell walls beneath the cover. This eliminates much of the weight of the old-type external links and their supporting posts, and being resiliently mounted in rubber bushings, set in rubber cement, this construction absorbs vibration and serves to lock the elements in place.

Under-the-cover cell connectors effect a shorter path and a lower voltage drop between cells and yield a correspondingly higher voltage at point of contact. Located below the liquid level, the heat of high discharge is dissipated through the electrolyte.

Plates are prepared to special formulas and combine high capacity under all temperatures. A new grid design ensures good retention of the active material.

Separators are of vertical grain cedar treated to ensure free action of the electrolyte, and are reinforced at points of wear with inlaid strips of vulcanized rubber.

A one-piece hard rubber cover has molded into its design a pair of manifolds through which acid gases, emanating from the cells while on charge, are conveyed to be neutralized before passing from the battery into the open air. Two glass tubes, each with three separate compartments, are inserted in opposite ends of the tubular manifold along the vent plug manifold. These tubes are filled with a granular acid neutralizing material to render harmless traces of acid in the gases. Leaving the vent manifold, gases enter the neutralizing tubes at opposite ends and exit from a common center through a duct from which the now harmless gases can be conveyed to a convenient point outside the ship. When necessary these neutralizing tubes can easily be replaced.

To facilitate accurate re-watering and avoid overfilling, a liquid level indicator is fashioned into the base of filler tube of each cell. Deep seal grooves are moulded into the underside to receive the compound employed in sealing individual cells.

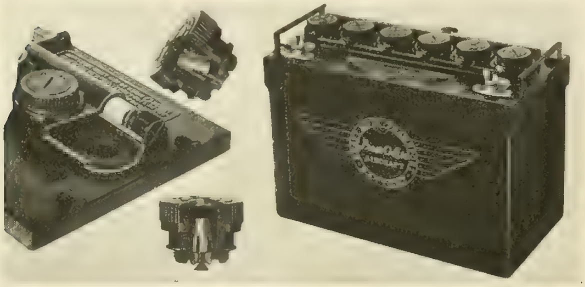
Non-spill vents permit the battery to be tipped in any position without loss of electrolyte. A hard rubber shell, with a gas-tight removable screw top, holds an inverted conical lead weight attached to which is a flexible rubber stem and valve. When the battery is tipped the cone topples over, pulling the valve head into a tapered seat, and closing the vent opening. When the angle of the battery is restored to within 45° of vertical, the cone, returns to its base, releases the valve from its seat, and the vent reopens. The complete assembly screws into the vent opening against twin gaskets, making a leak-proof, gas-tight cell.

Container is of shock-resisting hard rubber molded into a single unit. Lead-plated handles, screwed to the end walls, also serve to secure the cover.

A rubber sealing compound, resistant both to extreme heat or cold, seals the cover to the box. This adhesive material, when applied to a one-piece cover which is securely held under the metal handles, gives a perfect seal.

Terminals are located on top of the battery, are of the standard bolt and wing nut type, and are the only exposed lead parts.

Prest-O-Lite aircraft battery, its non-spill vents and section of the cover



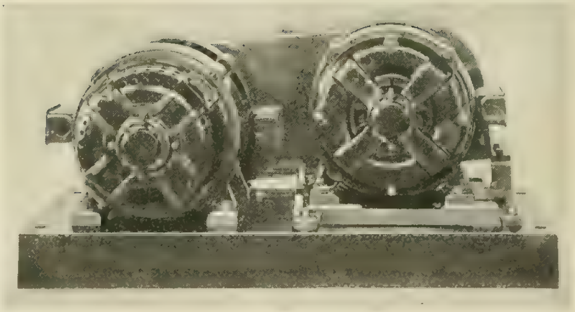
New Line Of Welders

Harnischfeger Corp. has developed a new line of simplified P & H Hansen *Smootharc* welders which feature single current control, self-excitation and internal stabilization. This new line is built in two styles—vertically mounted in 75, 100 and 150 amp. capacities, and horizontally mounted in 200, 300, 400 and 600 amp. sizes. Both models are uniformly and compactly built, streamlined to eliminate projecting parts and permit easy portability.

Single current control is made possible by shifting generator brushes. By a simple micrometer screw shifting device an infinite number of current settings is secured and the voltage is maintained automatically at a high value. A turn of one controlling dial quickly gives the desired welding current.

Smootharc welders are self-excited by a set of auxiliary brushes placed ahead of the main brushes and connected to an auxiliary shunt winding. No extra commutator is needed, thus saving weight, space, wearing parts and assuring long life.

Self stabilization is secured through the use of interpole winding extended to the main pole shoes in such a manner that it serves the dual function of interpole winding and stabilizing winding. This assures less spatter loss because speedy arc recovery is secured through the combination of short circuit winding and magnetic bridge located in the main field magnetic circuit. A lower cost per pound of metal deposited is claimed.



Electric Specialty's frequency changing motor generator

Electrical Equipment Checking Apparatus

High frequency alternating current electric power, derived from especially-designed gasoline engine driven generating plants, is being used on new large transports now going into service. The necessity for a suitable source of such current at airports where these planes are serviced, or where the plane's electrical equipment, heating and ventilation systems, engine starters, etc., are tried out, has resulted in the development of a line of new frequency changing motor generators.

Produced by Electrical Specialty Co., this new line operates from 60 cycle supply lines and provides 800 cycles, or other high frequency alternating current for use on the planes. These frequency changers are available in a variety of sizes and ratings which have been designed especially for airport use. Motor generators with direct current motors and with 25, 40 or 50 cycle motors are also available.

Non-corrodible parts are used, the units being especially insulated for use in the tropics and designed to operate satisfactorily in high temperatures.

Snow Removing Attachments

Airport managers and airline superintendents should find interest particularly at this time in a new one-way snow plow and a winged blade extension for the Auto Patrol models manufactured by Caterpillar Tractor Co., of Peoria, Ill. These attachments are designed for moderate snow removal, the equipment clearing a 10-foot swath.

Accurate and fast blade adjustments allow plow and blade to work close to the road, cleaning the snow right down to the surface to prevent ice formation. In many sections, this equipment will serve all snow removal requirements.

The plow is a self-contained unit that can be quickly attached to the front axles of the Caterpillar Diesel, No. 11 and No. 10.

(*Continued on following page*)

BABB AIRCRAFT SALES

INTERNATIONAL AIRCRAFT BROKERAGE ● U. S. EXPORT LICENSE NO. 124

ENGINES:

CYCLONES, Model SR1820-F2, new, 735 H.P. List price $8120; net each.	$6000
CYCLONE, Model SR1820-F52, 820 H.P. Same as new. List price $8600; net	6000
CYCLONE, Model SR1820-F1, 650 H.P. Practically new	3000
HORNETS, Model 1860B, geared, 575 H.P. 38 hours total time. Each..	1000
HORNETS, Model 1860B, direct drive, 575 H.P. Under 50 hours total time; overhauled and modified by P&W distributors. Each	1650
HORNETS, Model 1690A, 525 H.P. Under 400 total hours; overhauled and modified by P&W distributors. Each	1000
WASP SD—500 H.P. Under 100 total hours. Overhauled by P&W Factory. Equipped with controllable propeller	2500
WASP SC1's—450 H.P. Under 500 total hours; overhauled and modified by P&W distributors. Each....	1650
WASP C's—420 H.P. Under 500 total hours; overhauled and modified. Each	1350
WASP B's—420 H.P. Under 600 total hours; overhauled and modified. Each	$850
WRIGHT R975-A's, with D modifications — 330 H.P. Under 400 total hours; majored and guaranteed by factory distributors. Each	1250
WRIGHT R760-E's — 250 H.P. Majored and modified by Wright distributors. Each	1250
WRIGHT J-5's—220 H.P. Moderate usage; majored. Each	500
LYCOMING R-680—215 H.P. Majored and modified by Lycoming distributors	550

SPECIAL

While They Last!

New, genuine Wright J-6 Exhaust Valves, each . . $12.50

J-5 Exhaust Valve Guides, standards, each 1.50

J-5 Exhaust Valve Guides, plus tens, each 3.00

KINNER B-5—125 H.P. Newest type; factory rebuilt, with new engine guarantee	$850
KINNER R-5—160 H.P. Few total hours—like new	850
KINNER K-5—100 H.P. Front exhaust. Same as new	650
KINNER C-5—210 H.P. Under 400 total hours; majored and modified.	450

Following Engines in "As Is" Condition All average under 500 total hours:

No.	Type	Price Each
27	HORNET A-1's—525 H.P.	$500
18	HORNET B's—575 H.P.	850
25	WRIGHT R975's—330 H.P.	675
40	CURTISS D-12's—400 H.P.	500
18	CURTISS CONQUERORS — 600 H.P.	500
3	AXELSONS—150 H.P. 7 cylinder, air cooled	150
1	CHALLENGER—185 H.P.	195

AIRPLANES:

Aeroncas, Bellancas, Boeing, Curtiss Wright, Eaglerocks, Fairchilds, Fleets, Fleetsters, Fords, Lockheeds, Northrops, Pitcairn, Stearmans, Stinsons, Travel Airs, Wacos and others.

Engine parts—new and used—for Wasp and Wright engines at big discounts. Write for bulletin on bargains.

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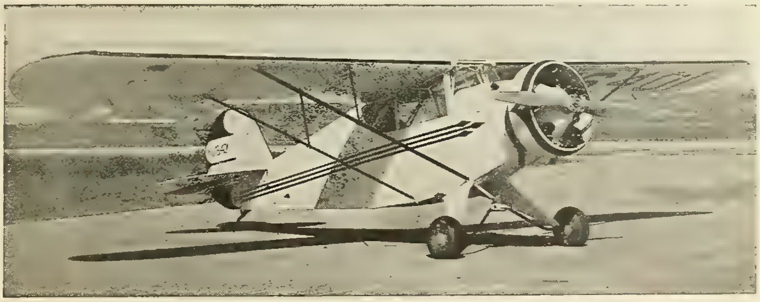
The sun never sets on PORTERFIELD *airplanes*



THEY enjoy the world's foremost safety record and are giving entire satisfaction in nearly every state, also in England, China, Australia, Canada, Puerto Rico, South Africa, Peru, Argentine, Chile, Brazil, Roumania, Mexico and Panama.

PORTERFIELDS' advanced engineering and low prices together with their top notch safety record and the fact that there is more performance in PORTERFIELD airplanes per horsepower than is otherwise known in the industry, has made these airplanes, which can be purchased for one-third down, the most popular fully powered complete airplane on earth today.

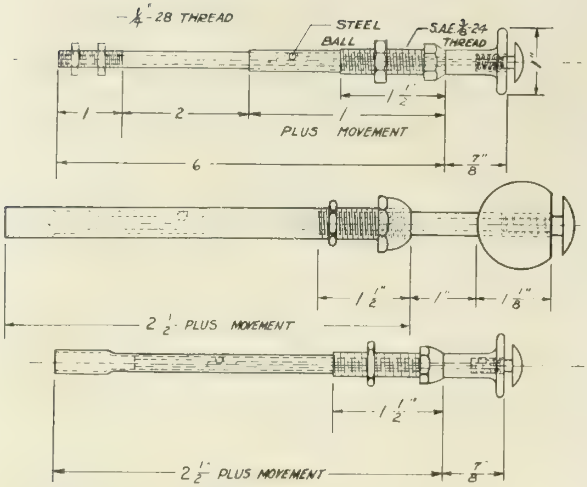
Many good territories are open for live-wire distributors. Write for our interesting booklet whether you are interested in making money from selling the foremost and most complete line of two-place sport trainer airplanes, or if you want one for pleasure. Our booklet contains interesting testimonial letters which have been received from owners all over the world and were sent to us voluntarily.

$1295 with Continental 40 engine—$1795 with Velie 65

$2095 with LeBlond 70 ***$2895 with Warner 90***

PORTERFIELD AIRCRAFT CORPORATION

2457 Charlotte Street **Kansas City, Missouri**



Diagrammatic sketch of the Arens locking type control unit for aircraft

(Continued from preceding page)

Constant Speed Propeller Drive

Use of the Hamilton Standard constant speed propeller on Wright 7- and 9-cylinder Whirlwind engines is now possible through the design of a new accessory drive for the rear of the engine.

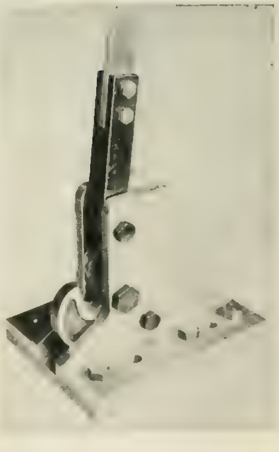
The accessory drive, attached below the right magneto at the fuel pump drive location, is a three outlet box using beveled gears. It affords a drive for the constant speed propeller governor, a fuel pump, and a vacuum pump. However, the driving gears for either the fuel pump or the constant speed governor or both may be omitted if those accessories are not desired. It can be installed on 7-cylinder Whirlwinds already in service by the usual mounting studs. The 9-cylinder Whirlwinds will require the addition of one stud for which provision has been made on the engine.

The constant speed propeller governor consists of an oil pressure pump and a centrifugally governed device for regulating oil flow. It is mounted on the drive by an adapter to which two oil lines are fitted: one from the engine oil supply to the adapter, the other from the adapter to the nose section, where it enters a fitting which replaces the hydro-control lever.

Locking Type Control Unit

A new and improved type of locking unit has recently been developed and introduced by Arens Controls. Original in design and simple in construction, this unit consists of a tubular housing threaded for dashboard mounting, and a tubular sliding member with knob for grip.

In the center of the knob, there is a plunger which has a hardened tapered portion. A steel ball bearing rides on this taper, the ball being held in position by a hole drilled through the sliding member, which also allows it to make contact with the housing. A compression spring is inserted under the button of plunger, the action being of forcing the ball up on the taper, which, in turn, wedges the moving parts into a unit. The unit is released by pressing the button on plunger which allows the ball to ride on the lower part of the taper, breaking the wedge effect. Surfaces are smooth, there are no parts to wear, and the unit can be locked at any position in its travel. It can be used for either a locking or friction device by varying the strength of the spring.



Porter UB Shear for cutting fine strand aircraft control cable

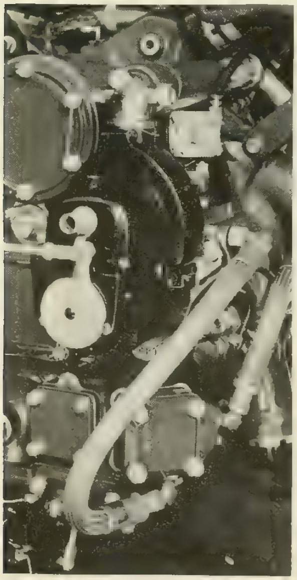
Cable Shear

The U B Shear is a bench mounting, one-hand shear for cutting fine strand airplane control cable and similar material. It has a capacity of ½" plow steel hoisting rope or fine stranded stainless steel airplane control cable, but is not designed for cutting solid rods.

A sturdy structural frame carries a fixed-shear blade with a vertical U-shaped opening through which cable can be dragged from a reel to a desired mark on the measuring bench. Then the operator need only pull the 30" handle forward and downward to sever the rope with a minimum of deformation.

The fixed and movable shear blades may be removed easily for grinding. Ample grinding stock is provided. The "wipe" of the blades is adjustable and easily controlled. All working parts are heat treated, and pivots of the blades are made of alloy steel.

The UB Shear is manufactured by the H. K. Porter Co., of Everett, Massachusetts.



Constant speed propeller governor installation on a Whirlwind engine

PIONEER SENSITIVE ALTIMETER

The newly designed Pioneer sensitive altimeter, featuring a direct reading barometric setting, employs two, and sometimes three, concentric pointers to indicate altitude in tens, hundreds and thousands of units.

The instrument consists essentially of an evacuated metal diaphragm sensitive to changes of atmospheric pressure, and a precision mechanism for translating the movement of the diaphragm, greatly magnified, to the hands of the dial. The diaphragm is of special alloy fabricated to a special design and treated to insure permanency of the instrument calibration. Every movable part of the mechanism is balanced, insuring correct indication regardless of accelerating forces or the attitude of the airplane. While the instrument is sensitive, it is not lacking in ruggedness and no effect can be noted within reasonable limits of instrument panel vibration.

To amplify the expansion of the diaphragm in as many as 35 turns of the main pointer, a system of two links, a rocker shaft, two gears and two pinions, is used. The reducing train for operating the other two pointers consists simply of a pair of gears for each. To provide smooth frictionless operation, the mechanism is completely jeweled and pins and pivots are hardened and polished. The instrument has complete built-in temperature compensation and the direct-reading barometric setting, in the form of a Veeder Counter, is incorporated in the lower portion of the dial, apart from the altitude scale. The setting shows directly the exact adjustment of the altimeter to existing atmospheric pressure conditions.

In connection with the military types which require a barometric pressure setting in equivalent feet of altitude, further advantage of this new system is gained. The counter setting is in feet of altitude above or below the standard atmosphere sea level "zero" (29.92" Hg.). The numerals appear as white figures against a black background for adjustments above "zero" and against a red background for adjustments below "zero". The color contrast avoids any possible misinterpretation of reading.

HELP WANTED

The sudden trend to metal construction makes it virtually impossible to hire men experienced in this new art. Our plans call for assembly plants in several foreign countries and our organization is obliged to supply our key men to assume the positions of responsibility in these enterprises. We must constantly augment our personnel for this expansion program.

Since most of our academic or vocational schools have not yet advanced their educational guidance to a point where their graduates are immediately competent for our specialized problems, we prefer to introduce an apprenticeship basis of training which combines fundamental theory with the actual and practical details of work and administration.

We will accept at this time a limited number of eligible young men who expect to earn their living in aviation, and contemplate paying for an education or training and who can qualify for the technical-apprenticeship plan we offer.

For requirements and full details state present education and qualifications when addressing your inquiry to:

LUSCOMBE AIRPLANE DEVELOPMENT CORPORATION
Personnel Department
West Trenton New Jersey

SCINTILLA
AIRCRAFT MAGNETOS
HAVE FLOWN WITH
TWA

As standard equipment since the beginning of this great company . . . and have contributed their part to its high performance:

168,000,000 passenger miles . . . over 100,000,000 of them with palatial TWA Skyline planes which have transported in excess of 1,000,000 pounds of air express and 6,000,000 pounds of air mail!

●

SCINTILLA MAGNETO CO., INC.
(Subsidiary of Bendix Aviation Corporation)
SIDNEY, NEW YORK

Personairlities

By Caldwell

• Gordon Darnell was awarded the Air Mail Medal of Honor for bringing down a burning ship and landing his passengers safely. On a flight from Kansas City, Mo., to Denver, Col., on June 28, 1933, when he was near Goodland, Kan., at a height of 2000 ft., Darnell smelled gasoline fumes. Fire followed immediately, breaking through the lower left side of the cockpit. He closed the throttle, switch, and right hand tank valve. The left hand tank valve could not be closed because it was in flames. He smothered the flames in the cockpit with a hand extinguisher, opened the cockpit windows, and put the ship in a nose-high sideslip, which partly cleared the fumes and kept most of the flames from the cockpit. He made a normal landing, but fire flamed again in the cockpit before the ship came to a stop, so Darnell climbed through the front exit and rode the wing struts until the plane stopped. The passengers got out without injury. All the mail except that in the cockpit was saved. The plane continued to burn right merrily until it was a complete loss—and as it was an old Hamilton I don't suppose anybody but the insurance company was really grieved.

Of course, it may occur to you that for a pilot with passengers, and without a parachute, there's nothing else to do but get the thing down. But there are various ways of getting it down, not all of which are guaranteed to work. Darnell's way worked. And he stuck to his post and kept his head—not the easiest thing to do in a burning airplane 2000 ft. above the nearest fire department. Shows you, too, how advancing science changes things. We're used to calling the fire department to a fire; we're not used to taking the fire to the fire department. With a little more experience of such things, Darnel would have been able to glide right down in front of the Goodland, Kans., Fire Department, and have saved that Hamilton. Not that I advocate saving a Hamilton—I once flew one for a short spell for Universal Airlines. It made more noise and less speed than almost anything I've ever been in, including the Interborough Subway. I hear that all of the old Hamiltons have been sold to Imperial Airways to speed up their service—but this may only be a rumor.

Gordon Darnell

Gordon Darnell was born in 1905 in Little Rock, Arkansas, made famous as the home of Col. J. Carroll Cone, now one of the Three Live Ghosts, as the triple-headed Director of the Bureau of Air Commerce is laughingly called.

Anyhow, Darnell was born in Little Rock, where he attended school, taking up automobile engineering, to the disappointment of his parents, who would have preferred to see him become something tricky like a lawyer, or even a banker. His father had spent all his life with the Missouri Pacific Railroad—it's forty years to date that he's been with it—and that's enough to discourage any family with machinery and transportation.

The family's worst fears were soon realized—Gordon joined the Arkansas National Guard as a technical sergeant early in 1925. That fall the 154th Observation Squadron was formed, and he became its first mechanic—one mechanic for seven Jennies. Through the efforts of such patriots as J. Carroll Cone, Asbury Meadows, and Murray Hall, young Darnell learned the mysteries of flight, such as they are. When 1927 found him the possessor of an appointment as Cadet in the Air Corps Flying School, he knew that he was on his way to higher things. In a year he graduated—one of the 13% of entrants finishing that class, which gave the air transport companies such pilots as C. T. Robertson, Lewis M. Gravis, Paul Reeder, A. C. Lybarger, Clifford Abbott, Eddie Eshleman, Kenneth Beer, George Boyd, Alexis Klotz, Sterling Boller, and others. That class was the Air Corps' gift to the operators; most of the boys became connected immediately with airlines, and stayed put.

Darnell's experience has included jobs with Paul Braniff on his original Oklahoma City to Tulsa passenger line, in 1928; with Carl Cromwell's line from San Angelo to Dallas, and San Antonio to San Angelo and Big Springs, in which Jimmy Mattern and James H. Walker were his fellow pilots. In May, 1931, he flew for United States Airways during the term of their mail contract, when he pulled his "Firemen save my child!" achievement and won his medal for it. When Braniff Airways were successful bidders on the mail contract, he returned to work for them—the company for which he helped pioneer their original line back in 1928, when carrying passengers called for the resourcefulness of every employee—not to mention the abiding spirit of trust and hopefulness displayed by the passengers.

CYDELITES on the NEWS

• I have an idea that whenever the Gods who run the Universe want to enjoy a good farce comedy they remark, "Let's take a peek in the monkey house and see what those amusing apes are up to now." Then they take a long-range telescope and look at our little World, the Zoo of Creation, and undoubtedly get a good laugh.

Perhaps they see my deluded old friend, C.G. (Center of Gravity) Grey, editor of *The Aeroplane*, writing an adulatory article about the dear German brothers, formerly the "'orrible 'uns." Mr. Grey, who used to 'ate the 'uns, has recently been crawling around Germany on his hands and knees, worshipping everything German. In his latest article Mr. Grey lets it out to the Gods and ourselves why he is so pro-German: General Goering actually ***spoke to him!*** Yes sir, General Goering, the cultured Aryan, spoke to Mr. Grey, who was simply dying to be spoken to, or in fact noticed at all at a German aviation meeting. Mr. Grey embalms the incident for posterity in these ineffable words:

"Dr. Baeumker ascended the platform and asked all the foreign visitors to adjourn to the salon, or foyer as we call it, to meet General Goering. Here about 40 or 50 of the Outlanders (foreigners) were drawn up in two rows, and General Goering, attended by General Milch and staff, came along and shook hands with each of the foreign representatives and said a few words to those of us whom he happened to know. I was pleased to see one of our own service representatives spring to attention and click his heels and bow from the waist with a delightful precision which would have done credit to the Prussian Guard before the war. It was a highly creditable performance considering the appalling difficulty of looking the least bit smart in Air Force uniform, but of that I may have more to say when I come to the

(*Continued on following page*)

Powered with LeBlond 70 h.p. and 90 h.p. and Warner 90 h.p. motors

As standard equipment the Model 8500 REARWIN is now powered with the LeBlond 5F motor which has recently been approved by the Bureau of Air Commerce for 90 h.p. The REARWIN with this increased power has even faster take-off, quicker climb, and several miles more speed.

Deluxe models now available with wonderfully sensitive ball-bearing controls concealed under floor boards. In these models, one of the two luggage compartments is under the rear seat.

Workmanship and Materials used on all REARWIN planes are equal to those of highest priced airplanes. You need pay only ONE-THIRD down!

See the 1937 REARWIN at the Miami, New York City, and Los Angeles Air Shows

REARWIN AIRPLANES

Ninth Continuous Successful Year

FAIRFAX AIRPORT—KANSAS CITY, KANSAS, U.S.A.

"Rearwin popularity is proof of Rearwin superiority"

Don't Be Misled . . .

. . . by the exaggerated claims of one of our competitors. Facts prove that the REARWIN is definitely the FASTEST licensed commercial airplane priced under $3500.

But SPEED IS NOT ALL . . . The REARWIN is the ONLY airplane selling for less than $3500 which has ALL these features, and is the ONLY airplane selling for less than $3000 that has ANY of these features . . . 24 gallon fuel capacity in wing tanks . . . 475 mile cruising range . . . hydraulic landing gear with unusually wide tread . . . 50 lbs. luggage capacity including space for a full size Gladstone bag . . . 50 lbs. additional allowance for extra equipment . . . unexcelled visibility in every direction . . . comfortable cabin with head, shoulder, and leg room for everyone . . . superior finish of many coats of finest materials . . .

Too, the REARWIN is recognized as having the fastest take-off . . . quickest climb . . . highest ceiling . . . and slowest landing of any plane anywhere near its price. These qualities are especially valuable at high altitudes or on fields of limited area.

These are the features YOU want in the airplane YOU BUY! Whether you are a sportsman pilot or school operator, it will pay you to investigate the REARWIN, fastest selling two place airplane from $1600 to $5000. (See Bureau of Air Commerce bulletin of October 1st, 1936.) Write or wire for complete details TODAY!

"Time Flies" with HASKELITE

AIRCRAFT PLYWOOD – USED WORLD OVER

Frank Hawks says: "My men and myself were particularly impressed with the quality and strength of all the Haskelite Plywood used in the construction of 'Time Flies'. I believe there have been marked advances made in the fabrication of this splendid material."

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(*Continued from preceding page*)

German Air Force. Thereafter General Goering ascended the rostrum and welcomed the assembly. He impressed on them the value of co-operation not only between the various branches of German aviation but between nations of similar sympathies, above all between nations which saw that the peace of the World depended upon international cooperation."

Isn't that paragraph a honey? It puts Grey right up there with the world's most renowned unconscious humorists—for of course the dear old lad hasn't the remotest idea that those words are funny; he means every one of them, and is simply in a dither of fluttering titillation to think that he has clasped the cultured paw of a Goering. Grey probably would like to see the English exchange their emblem of the lion for a dachshund.

● If General Goering's yearning for international co-operation has been correctly reported by Cousin Grey of Piccadilly, then it is cause for sorrow that the General's country has been so little in sympathy with his peaceful longings that it has permitted German pilots in German airplanes to proceed to Spain to help the rebel General Franco kill a lot of other Spanish people whom he doesn't like. It is also cause for wonder that despite the anxiety for World Peace expressed by Mr. Mussolini of Italy, several Italians in their warplanes also have gone to Spain to help General Franco decrease the number of Spaniards able to sit up and take nourishment. Now,- you'd think that Mussolini, of all people, would have those Italians of his well in hand, and would be able to prevent their flitting to a foreign land that has trouble enough of its own without outside assistance. But no! Those Italian pilots simply left Mussolini as flat as ravioli, making his speech about olive branches—and also olive oil and banana oil—while they went gaily off to engage in a little slaughtering of Spaniards.

As for the other side of the Spanish argument, there is France, Left-wing itself, and Russia, dedicated to the peace of the whole cock-eyed world (*after* the World Revolution) both sending the Spanish Loyalists some nice shiny French and Russian warplanes in assorted sizes, complete with pilots, so they could do battle with the nice shiny warplanes contributed to the Fascist rebel side by the two leading Fascist countries of Europe. All of which, I submit must be highly diverting to the Gods of Olympus.

I don't know what, if any, new lessons our military people have learned from the Tom Thumb air warfare in which the Spaniards and their oddly assorted unofficial allies are engaged. Our General Staff, of course, has learned nothing—having their minds fixed firmly on the ground. Our GHQ Air Force Staff, however, may have learned something and profited by it. Not that the small air activity of the Spanish squabble is much to base conclusions on, even if we had the full details. But from these little engagements between a few planes, and from the amount of destruction and general disruption of communications and destruction of civilian morale, it should be possible to learn at least a little more than we had deduced from our theories based on the antiquated flying machines and tactics used in the war of 1914-18.

The slight amount of non-technical information available to date confirms the conclusions presented in my article on the value of Pursuit *versus* Bombardment, in the March, 1936, issue of Aero Digest. Some Air Corps officers said then that I was wrong, others said I was right; the still incomplete air information coming over from the Spanish war says that I am right—so far. My belief, frankly, is that all war will be stopped by the simple means of making it so conclusively destructive that no tribe of men or monkeys can afford to wage it.

● On the Home Front, thank God, all is peace, charity, and good will. That great patriot James A. Farley assures us that charity and good-will must prevail. The taxpayers will foot the bill for the charity, as usual, and the good will may come from the radio "Good Will Court" of Chase & Sanborn's Coffee. It certainly won't come from the Republicans, many of whom took to the brush on Nov. 4, shooting ducks, or just taking to the brush, duck or no duck. I took to the woods myself, meeting an Indian who said he was the last of the Mohicans. I told him I was about the last of the Republicans, so we pitched camp together at Lake Oblivion, up in Vermont. I shot a rabbit and the Mohican shot a prowling Democrat.

* * *

And the poor old duPonts! You know, I was worried about them for a time, until I learned that they were marrying into the Royal Family. Getting the Roosevelts and the duPonts together is just like getting the Montagues and Capulets of "Romeo and Juliet" to kiss and make up. It's the sweetest thought of the day.

Well, the thing to do is to back the President to the limit, and for all of us to pull together. And just to be helpful I want to suggest right now a plan that will save the President considerable embarrassment in a year or so, when all this flock of national debt starts really to crowd us—and it's going to catch up to us, don't make any mistake about that. A man or a nation goes into debt just so far, and then the bailiffs come in. Well, let's anticipate that and make things easy as we can. Let's get the Supreme Court to declare arithmetic unconstitutional! Repeal arithmetic, and print all Treasury reports of the deficit in algebra—nobody but a few engineers understand algebra. Then when someone says, "What's the national debt standing at now?" the President can smile genially and say, "$X - 2\ CX\ B = Y$." I guess that'll hold us Republicans.

● When a New York woman who had been on Relief for some time found a job and saved up enough to return $150 to the Emergency Relief Bureau, the officials nearly had a heart attack. It was the first time that had happened in New York. There is a movement on foot to erect a statue to that fine woman. Now, it happens that a well-known pilot borrowed $150 from me five years ago, has had a job every day since then, and hasn't yet returned a penny of it. If he pays it back I shall have him stuffed and mounted for the Los Angeles QB Hangar.

● There's an amusing aspect of this Spanish omelette that reminds me of my own old war days. Have you noticed that with all the bombing going on that General Headquarters on both sides have never been bombed? That is in line with the ethics of war—the Generals have an unwritten agreement not to harm each other. Haig and Pershing and Hindenburg and the other brass hats in the last big war had it thoroughly understood that their Headquarters were to be spared.

I once requested permission to bomb a German Field Headquarters, then at Courtrai, hoping to pick up an easy medal for helping to win the war. Permission was of course refused. "Don't be silly," laughed our Squadron Commander. "Do you think Headquarters wants to stir up the Germans into bombing our own brass hats at Hesdin?" I found to my surprise then that the brass hats on opposing sides take care of each other! It's only the riff-raff, such as lieutenants, sergeants, corporals, and privates who get rubbed out in a war.

● The Patent of the Month, as selected from the Journal of the U. S. Patent Office, is No. 2,054,402, an exercise gadget for holding the lower part of the body in a clamp and permitting the upper part to swing about in a daze. Rendered groggy by considering this invention, the patent office tears its hair and attempts to describe the thing in these clear and concise words: "An exercising apparatus comprising means for receiving and supporting a portion of a human body about the middle portion thereof with the longitudinal axis of said body at an angle to the vertical, while leaving the upper portion of said body continuously unsupported, means rotatably supporting said supporting means for rotation about an axis extending longitudinally of said body, and additional supporting means removed from said first-mentioned supporting means along said longitudinal axis and positioned for engagement by the feet of said body for effecting rotation of said body about said axis." You said it! The bird who wrote that paragraph should be an editorial writer on Cousin Grey's *Aeroplane*.

● From Williams Lake, B. C. Canada, the AP reports that a hunter who shot a Canada goose also killed a passenger—a humming bird travelling south, nestled in the feathers of the goose. These little aerial hitch-hikers are fairly common, you know, and it is nothing unusual up North to see a small bird standing hopefully beside a goose, thumbing his way toward Miami. I remember out at Tulsa one day catching up to Frank McKay as he was striding over the airport—you know what a mastodon of a man Frank is. Well, will you believe it?—I found a small boy stowed away aboard Frank, and he not knowing a thing about it. Frank carries a periscope so he can look down around the front and see if his shoe laces are tied.

● Fred Neely, press agent for the Bureau of Air Confusion, heads a recent press release "Air Lines Employ 270 Hostesses and 42 Stewards." That's not enough hostesses to go round, Fred. United Air Lines called their copilots "Mates," and as they also have Stewardesses, Pop Cleveland named the trio "Pilot, Mate, and Playmate." Pop *would* think of something like that. Pop can deflate people quicker and easier than anyone I know. You get into an argument with him and have him tied up, and he just looks at you with contempt and says quietly, "All right, if you're so smart, why ain't *you* rich?"

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DIGEST OF THE NEWS

PRIVATE FLYING

Miami Race Program

Schedule of racing events for the Ninth Annual Miami All-American Air Maneuvers, Dec. 10-12, as approved by the Contest Committee of which Capt. R. J. Walters is chairman, is designed to determine the national stock plane racing championships in various classes.

Featured races, open only to "C" licensed planes, are: The Glenn H. Curtiss Trophy Race, 8 laps over a 5-mile course, unlimited displacement, $1200 purse; The Col. E. H. R. Green Trophy Race, 5 laps over a 5-mile course, 850 cu. in. displacement or less, $1200; 550 cu. in. displacement or less race, 5 miles over a 5-mile course, $800; 200 cu. in. displacement or less race, 5 laps over an approximate 2.5-mile course, $300; The Clare W. Bunch Trophy Race, 4 laps over a 5-mile course for Monocoupes only, $500; the Aviation Manufacturing Trophy Race, 4 laps over a 5-mile course for Stinsons only, $500; and the Women Pilots Free-for-All On to Miami Cruising Contest to be raced in two legs — Jacksonville-Orlando, Orlando-Miami—$500 purse.

In addition, the *Detroit News* Trophy will be in competition as part of the Aircraft Exhibit to be held at the airport beginning Dec. 6 and continuing through the races. This is a stock model contest judged upon cruising economy, beauty, private owner features, barrier take-off and landing and straightaway speed. Also, a thousand dollars has been guaranteed by the city for award to pilots establishing official world records in the FAI categories.

The Navy Stunt Team from Pensacola will perform daily as will three squadrons of Marine Corps fighting planes from Quantico.

Culminating the flying program, will be an international Miami-Havana Air Cruise starting on the 13th and open to licensed pilots. This event, staged at the invitation of the Cuban National Tourist Commission, will provide participants with a 3-day stay in Havana as a guest of that city and of the Tourist Commission. Trophies are being provided by the City of Havana and the Commission.

Tours to the Races

Groups of pilots flying Aeronca and Taylor *Cub* planes will converge on Miami for the races. Plans are well under way for a Caravan of Aeroncas to leave Cincinnati December 6, the group being scheduled to arrive in Miami on the 9 or 10, depending on weather conditions. Stops will be made at Lexington and Williamsburg, Ky.; Knoxville and Chattanooga, Tenn.; Atlanta, Macon, McRae and Waycross, Ga.; and in Florida at Jacksonville, Daytona Beach, Orlando and Vero Beach before arrival in Miami.

C. I. Friedlander, one of the directors of the Aeronautical Corporation of America, will be in charge of the cruise and will fly a new Warner-powered low-wing job. There also are plans for an eastern wing of the cruise to leave New York and join the Cincinnati division at Atlanta. Estimates of J. C. Welsch, Aeronca sales manager, are that from 30 to 50 Aeroncas will make the trip.

* * *

The *Cub* Convoy will leave Atlanta December 7. With 39 entries already received, the proportion of participation already has exceeded expectations. It is now planned to fly direct to Americus, Ga., where there will be an overnight stop. From there the Convoy will proceed to Miami via Lake City, Orlando (overnight stop) and Vero Beach, Ft. Pierce, Stuart, West Palm Beach, Ft. Lauderdale and then into Miami.

Cups and cash prizes have been donated by various civic groups along the route as well as by representatives of the Pure Oil Co. and the Gulf Oil Co. The Trophy Committee of the Miami races has also set aside prizes for winners of the various events planned for the small planes during the races themselves.

Safety Increases

Miscellaneous aircraft operators —those engaged in flying services, schools, aerial photography, crop dusting and the like—flew 691,951 miles per fatal accident and 1,012,612 miles per passenger fatality during the first six months of 1936, establishing new safety marks in both of these classifications. The number of miles flown per accident for this period was 52,620, slighty less than the 56,828 miles during the comparable period in 1935.

Causes of the 789 accidents recorded during the period in question and which occurred in this type of flying included: personnel errors, 49.12%; engine failures, 15.8%; airplane failures, 10.38%; weather, 9.07%; darkness, 0.84%; airport, terrain or water, 11.3%; other causes, 3.11%; undetermined and doubtful, 0.38%.

Increases in safety also were seen in reports of 864,939 miles flown per pilot fatality. This compares with 600,510 miles for the January-June period in 1935.

SCHOOLS

Enrollments

Eighty new students, representing 29 states and Central America, Canada, Hawaii, Alaska and China, registered in the October 1936 class of the Boeing School of Aeronautics. This is one of the largest classes in the history of the school.

* * *

Late fall enrollments for flight and ground school instruction at the Ryan School of Aeronautics include four new students, one of whom is from Mexico City.

Fleet Increased

Number of planes in the flight training line of Parks Air College has been increased to 12 by the purchase of a third Kinner *Sportster* for use in primary work and a new twin-engined Lambert *Monocoach* for advanced training.

New Courses

Practical air transport and aeronautical engineering courses, designed to qualify students for engineering jobs in aircraft operations and manufacture, are being developed at the Boeing School of Aeronautics for enrollment beginning with the Fall Quarter of 1937. Combining practical and technical training, the new courses will be of 24 months duration, admission requirements consisting of two years of pre-engineering at an accredited college or university.

The Practical Aeronautical Engineering Course will include technical training designed to meet all engineering requirements, coupled with practical training covering the construction of airplanes and component parts, the building, maintenance, repair, and installation of radio, and instrument equipment, and the overhaul and installation of motors used in training and transport planes. The Air Transport Engineering Course will substitute for advanced design, an advanced study of avigational aids including radio and instruments, meteorology in its higher stages, air transportation principles, and airport design. In addition both courses will cover many subjects of a technical and practical nature.

* * *

Parks Air College has opened an air communications course for post graduate students and experienced airline men. The course is planned to qualify students for the federal communications test for radio telegraph operator's third class license, and radiophone operators' second class license. Charles J. Schwarz has been appointed associate professor of radio.

* * *

The University of Notre Dame is offering this year a new 4-year course on the study of metals in its department of aeronautics. The first two years of the course aim at a thorough grounding of the student in mathematics and physics, principles of which are applied in the technical courses of the last two years. Prof. Frank N. M. Brown, formerly of the airplane division of Ford Motor Co., and consulting engineer for Goodyear - Zeppelin Corp., and Stout Engineering Laboratories, heads the department. Courses in metallurgy is in charge of Dr. Edward G. Mahin.

* * *

New York Section, American Welding Society has arranged with the Brooklyn Polytechnic Institute for the presentation of a series of lectures on the fundamentals of welding. Lectures are given in the Institute on Tuesday evenings.

Course comprises ten illustrated talks covering characteristics of the welding arc and welding flame; metallurgy and metallography of the welding of steel; physical properties of welds; welding in engineering and building construction; weld inspection and supervision; the welding of alloy steels and nonferrous metals; the economics of welding and the selection of welding processes.

AIR SERVICES

New Primary Class

New class at Air Corps Primary Flying School, Randolph Field, comprises 164 students. Of these, 61 are Second Lieutenants of the Regular Army who graduated from West Point last June, and were assigned to duty with the Air Corps for flight training;

95 are candidates from civil life; 4 are enlisted men of the U. S. Army Air Corps and four are enlisted men of other branches of the Regular Army. Civilian and enlisted students undergo training under Flying Cadet status.

Trophy Winners

The Third Attack Group at Barksdale Field credited with having the lowest accident rate per 1000 flying hours in the training year 1935-1936 has won the Colombian Trophy.

The trophy was presented to GHQ Air Force, in the name of the Republic of Colombia, by Major Benjamin Mendez, Colombian officer, during GHQ maneuvers in the vicinity of Miami, Fla., in December, 1935. It is proposed to award this trophy annually to that group in the GHQ Air Force having the lowest accident rate per 1000 flying hours each training year, as determined by the Inspection Division, Office of the Chief of the Air Corps.

* * *

Herbert Schiff Memorial Trophy, awarded annually to the Naval Aviation activity with the highest record for safe flying, has been won by VN Squadron 8D5, U. S. Naval Academy, Annapolis, Md. The squadron, commanded by Lieut. Comdr. Andrew C. McFall, flew 4154 hours to win the trophy and was in competition with 82 other naval aviation activities.

VN Squadron 8D5, maintained for the indoctrination and training of midshipmen in connection with the subject of aeronautics, is equipped with planes of the patrol and seaplane type.

Personnel Increase

Army Air Corps personnel was increased by 50 recently when that many reserve officers were appointed second lieutenants under the Thomason act, the 1935 amendment to the National Defense Bill. Aimed to give the Army the ultimate in flexibility, 50 officers are selected from 1000 Reservists who are authorized by the same bill for active duty for one year in all branches of the army. The Reserves are drawn from all parts of the country and each year competitive examinations are held. The 50 making the highest grades receive regular commissions.

Expansion

Headquarters of the 116th Observation Squadron, Felts Air Field, Spokane, is being augmented. A two-story addition is being built to house the squadron's field control radio tower and provide more space for officers' class-rooms. Increased space has become necessary through arrival of the new radio equipment that supplements that long in use, which has become inadequate.

* * *

Representative Lester Hill will recommend to the House Military Affairs Committee a building program for Barksdale Field, unofficially estimated at approximately $2,000,000. Mr. Hill went to Shreveport to inspect Barksdale Field with Colonel Adna Chaffe, War Department budget officer. Barksdale Field officers have learned that about 30 new attack planes will be allotted to the Third Wing there.

* * *

Naval reserve units operating from the Great Lakes Naval training station near Chicago, are preparing to move quarters and equipment to Curtiss field, near Glencoe, Ill., as soon as a number of alterations have been made on the large hangar now leased and operated by the Chicago Aviation Corporation.

* * *

New equipment is being installed at Brooks Field, Texas. A tower for a remotely controlled wind indicator is placed in front of the transient hangar, and a bank of B-9 floodlights are being placed at the northeast end of the field and one bank at the west end of the field. It will be some time yet before the lights will be used as the new runways are still under construction.

117 Basic Trainers

The Secretary of War recently awarded to North American Aviation, Inc., an order for 117 basic training airplanes. Total contract, which includes provision for spare parts, amounts to $1,432,600. These planes are being procured for use at Randolph Field.

The new trainer is a two-place low-wing monoplane, powered with the 400 hp Wright R975-7 engine. Although somewhat slower, this plane is similar in appearance and general handling characteristics to the modern pursuit plane, and at the same time has the ease of maintenance, combined with sturdiness of construction which is required in a training plane.

* * *

Award of a $6,056,500 contract for 66 VPB type twin-engined patrol bombers has been made by the Navy Department to Consolidated Aircraft Corp. Another Army award to North American was for 120 three-place observation planes at a cost of $3,429,600.

AIRPORTS

Personnel Notes

Michael Harlow, veteran Boston pilot, has rejoined Inter City Airlines to fly in charter and stu-

(*Continued on following page*)

You're Crazy
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Mom took up sky-writing on the sly, and she's having a swell time "telling" pop. ▶ We'll wager she's often wished Sherwin-Williams made "sky-writing" paint too, because on her ship she's learned what Sherwin-Williams means in lasting beauty and protection. ▶ To the amateur flier there's an added pride in flying a ship handsome in its smooth, brilliantly colorful and durable Sherwin-Williams Finish. ▶ To the commercial flier Sherwin-Williams light, weather defiant, proper tautening Opex Dopes add economy and safety, and the beauty of these finishes wins patronage. ▶ Manufacturers have found Sherwin-Williams the best answer to a finish that combines maximum eye appeal, permanence and easy workability, with lower finishing costs. ▶ For full particulars about Sherwin-Williams Aeroplane Finishes and hangar maintenance paints write The Sherwin-Williams Co., Cleveland, Ohio, and all principal cities.

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Fig. 1887

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(Continued from preceding page) dent operations. He just completed his seventh summer with Winnipesaukee Air Service of New Hampshire.

* * *

Elmer H. Leighton has been appointed manager of the municipal airport at Manitowoc, Wis. Leighton is in complete control of the airport and is authorized to conduct a flying school and arrange for storage of private planes in the city hangar.

Traffic Increase

With 12,325 passenger departures from the Chicago Municipal airport in October, records for travel from that city were broken for the fourth consecutive month. According to Edward J. Eidson, manager of Consolidated Airlines ticket office at the field, this was a gain of 39% compared with Oct. 1935, when total departures were 8864. During the last four months 49,908 passengers used the Chicago airport for their point of departure.

New Wind Tee

A manually-operated and neon-illuminated wind tee which will distinguish traffic lanes for incoming ships has been designed by the Lambert-St. Louis Municipal Airport management and installed atop the terminal building there.

The tee is set in any position by remote control from the control tower, and is locked by an electric brake. Framework is covered with sheet aluminum and is painted international orange. The wind direction indicator is used to guide the setting of the tee.

New Airports

Aberdeen, Miss., Eddie Stinson Airport. Three runways — two measuring 2500 ft. × 500 ft., one 3000 ft. × 500 ft.; lighting system, hangar. WPA and state project.

Corinth, Miss., Turner Airport. Four runways—two 2500 ft. × 500 ft., one 3000 ft. × 500 ft., another 2000 ft. × 500 ft.; lighting system, hangar. WPA and state project.

Nashville, Tenn., new municipal airport, 5 miles from city. $800,000. WPA and state project.

San Francisco Bay District, Calif., Mountain View Airport. Two miles from town. Instruction in flight and ground work.

Tupelo, Miss., Cone Airport. Four runways—two 2500 ft. × 500 ft., one 3000 ft. × 500 ft., another 2000 ft. × 500 ft.; lighting system, hangar. $45,000. WPA and state project.

Improvements

Birmingham, Ala., municipal airport. Proposed plans for construction of hangar and 2 runways; repairs to drainage and lighting systems, to buildings and field surface. $242,092. WPA and city project.

Dallas, Tex., Love Field. Extension of taxi-strip. $3820 WPA appropriation, $1072 city appropriation.

Oakland, Calif., municipal airport. Control tower to house Bureau of Air Commerce and airport control station.

Omaha, Neb., municipal airport. New lighting installation; replacement of flood and boundary lights; transfer of lighting controls to administration building $25,000; resurfacing runways; completing drainage system. WPA project.

San Francisco, Calif., municipal airport. Runway paving program, new administration building progressing on schedule. $3,000,000. WPA and city project.

Toledo, Ohio, Transcontinental Airport. Extension of runways, additional drainage and lighting facilities. $200,000 WPA; $150,000 city.

AIRLINES

Traffic Meeting

A three-day traffic convention held in Dallas last month under the auspices of Braniff Airways, Inc., stressed the importance of co-operation between airlines and express agencies which forward packages over these lines, in the interest of improved general service to the public.

Among those at the convention were T. E. Braniff, Charles A. Beard, and Don C. Waldbridge of Braniff Airways; L. P. Bergman, general manager of its Midwest department; E. K. Stone, general manager, Texas department, Railway Express Agency; D. C. Wren, manager, Dallas district, American Express Agency; John Walker, vice-president, Transcontinental and Western Air; Sam Wilkes, Southern division manager, Eastern Air Lines; Leigh Parker, general traffic manager, Delta Air Lines; Malcolm Doss, general traffic manager, Hanford Airlines; Rogers Humphreys, general manager, Chicago & Southern Air Lines; John Schlegle, manager, foreign traffic department, Pan-American Airways; and Willis Lipscomb, district sales manager, American Airlines, Inc.

270 Hostesses Employed

There are now 270 women employed as hostesses, and 42 men employed as stewards on American-operated airlines. Four domestic lines—American Airlines, Transcontinental and Western Air, United Air Lines and Western Air Express—employ hostesses and at present, one line —Pan American Airways—employs stewards.

Safety Record

Scheduled airlines of the United States flew 798,168 miles per accident, 6,704,615 miles per fatal accident and 7,574,134 passenger miles per passenger fatality in the first six months of 1936 according to reports of the Bureau of Air Commerce.

There were 42 accidents on the scheduled lines during the period, 5 being fatal, in which 4 pilots, 2 co-pilots, 2 members of crews and 27 passengers were killed.

Personnel errors, with 41.07%, lead causes of accidents; other causes were power plant failures, 13.09%; airplane failures, 23.81%; weather, 6.55%; airport and terrain, 10.72%.

Statistics cover all operations of American - operated lines, those within the United States and those extending to foreign countries. Domestic lines in this period had 39 accidents and flew 745,600 miles per accident. Foreign extensions had 3 accidents, and flew 1,481,557 miles per accident.

New Airline

Pacific Inland Airways has established a passenger and express service to Yakima, Wenatchee and Seattle, and has located its ticket office at the Blankenhorn Travel Bureau in Seattle.

Service is provided by a tri-motored Boeing which bases at Boeing Field. Arthur L. Lewis is president and Mark Dearborn vice-president in charge of operations for the company.

* * *

Seaplane service between downtown New York and Philadelphia, on a 48-minute schedule, is now being operated by Keystone Airlines, Inc. Twin-engined Sikorsky S-38 amphibions, fully equipped with radio, are making three round-trips daily between the 31st Street East River seaplane ramp in New York and the Philadelphia Skyport at Bainbridge Street on the Delaware River in Philadelphia. George E. McGowan is New York manager and Harold Moon, operations manager of the new line.

Consolidations

Ownership of Wedell-Williams' 338-mile mail and passenger route between New Orleans and Houston passed to Eastern Air Lines, which after the purchase announced that through service between New York and Houston would be inaugurated as soon as the air mail contract is approved.

* * *

Pennsylvania-Central Airlines Corp. has been formed to take over the mail, passenger and express operations formerly conducted by Pennsylvania Airlines & Transport Corp., and Central Airlines, Inc. These operations include the territory between Washington, D. C. and Milwaukee, via Pittsburgh, Akron, Cleveland, Detroit, Pontiac, Lansing, Grand Rapids, and Muskegon—748 miles in length.

The new company is operating multi-motored Boeing and Stinson planes and its activities are being guided by an executive personnel consisting of John F. Miller, chairman of the board, C. Bedell Monro, president; Frederick R. Crawford, vice-president and secretary; W. J. Austin, vice-president in charge of traffic; R. G. Lochiel, treasurer; and J. H. Coulter, assistant secretary and assistant treasurer.

Present schedules call for 8 round trips daily between Detroit and Washington and two daily round trips between Milwaukee and Detroit.

More Pilots

Anticipating substantial business increases in the coming winter months, Transcontinental & Western Air, Inc., has employed additional personnel and is planning increased service at a time when the usual winter practice would call for lay-off of employees and suspension of flight schedules.

Twenty pilots, some for TWA's new freight service between New York and Chicago, have been employed. In addition, a substantial number of hostesses and maintenance department workers, most of them mechanics, also have been put on the TWA payrolls.

Personnel Notes

The 1936 Gold Medal of Achievement, awarded by the Poor Richard Club of Philadelphia to that citizen of the United States whose life and interests best typify advancement in some field of endeavor will be presented to Capt. E. V. Rickenbacker, general manager of Eastern Air Lines. The presentation will be made on the night of the Poor Richard Club's annual dinner, at the Bellevue-Stratford Hotel, in Philadelphia on Jan. 15.

* * *

United Air Lines has appointed Donald F. Magarrell, meal service expert and former vice-president of R. M. Grinstead Co., to the position of director of meal service. He will be responsible for supervising menus on United's planes as well as meal service at certain points on the ground along the route.

* * *

Rufus Lee Carter, formerly Western Air Express traffic representative in Los Angeles, has been elevated to the district traffic managership in the Los Angeles district and will have supervision over sales activities within the area.

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$200
Was $1470
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CUB

The World's Fastest Selling Airplane

Air-minded America! Here's your chance to own your own plane at no more than the cost of a medium-priced motor car! But hurry! Our recent price reduction on the New Silver Cub has resulted in an avalanche of orders. But as the costs of labor and materials are mounting daily, we cannot guarantee this price for any definite period. So buy now—and save!

The New Silver Cub is America's **safe** airplane. Seamless steel tubing, welded sections and precision workmanship give sturdy construction. It's rugged—reliable enough to fly anywhere. And it's economical—even more so than a popular-priced car. The Cub uses only 3 gallons of gas and 1/3 pint of oil per hour! At only $1270 F.A.F. Bradford, Pa., it's an airplane practically everyone can own—aviation's biggest value! Easy monthly payments, if you desire.

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FREE! **Handsome Descriptive Folder** Send for it today—and the name of your nearest Cub dealer. Paste coupon below on penny post card, if you wish.

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RYAN AERONAUTICAL COMPANY ANNOUNCES

the

appointment of

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North Beach Airport, Jackson Heights, N. Y.

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distributor for the

RYAN S-T

in

New York

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New England

●

Now plane owners, pilots and dealers in the East may examine and fly—conveniently—the high performance, safety-featured, RYAN S-T.

The RYAN S-T incorporates such modern innovations in design and construction as the all metal fuselage, wing flaps for short landings, and trimming tabs. These are standard features on all models of the RYAN S-T series. But you should see them for yourself.

The Whitney organization is ready to demonstrate these features **now**—and to service RYAN S-T's in the East with a completeness of facilities rarely found outside of the manufacturer's plant.

Immediate Delivery
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90 h.p. **125 h.p.** **150 h.p.**

RYAN AERONAUTICAL COMPANY

LINDBERGH FIELD

San Diego **California**

Frank Samuels boarding a TWA Douglas at Oakland for his fast round-trip journey

Fast Trips

Utilizing regular scheduled transport facilities of Transcontinental & Western Air, Inc., the west coast manager of AERO DIGEST and THE SPORTSMAN PILOT, Frank E. Samuels, flew from Los Angeles to Newark, N. J., and returned in an elapsed time of 34 hours 37 minutes, the fastest round-trip flight recorded to date.

The trip started at Union Air Terminal at 9 pm, Oct. 27 and terminated 7.39 am Oct. 29. Flying as a guest of TWA which was honoring him on his 78th birthday, Samuels complimented the efficiency and dispatch of the twelve pilots who handled the Cyclone-powered Douglas airliners on the various legs of the flight—Collins, Kaye, Mesker, Keavitz, Smeley, Johnson, Graves, Enyart, Parker, Williams, Grow and Morehouse—as well as the hostesses — the Misses R. E. Baker, Frances Wilkins, Evelyn Burns and E. V. Rizer.

* * *

A new record for scheduled transport flights between Boston and Portland was established when the regular afternoon ship of Boston-Maine-Central Vermont Airways made the 96-mile trip in 27 minutes, at an average speed of 214 mph. Six passengers were aboard the Lockheed *Electra* when Pilot Stafford R. Short established the record.

Lower Fares

Substantial fare reductions over the Chicago & Southern Air Lines route went into effect November 1, in many cases the cut bringing point-to-point fares down to the level of first-class rail rates. A discount of 10% on round trips, and 15% on scrip and travel cards also will apply.

Chicago & Southern introduced Lockheed *Electra* planes on its route from Chicago to New Orleans on May 1, and the company will continue to operate two round trips per day between Chicago and the Gulf.

740,238 Passengers

Scheduled airlines operating in continental United States during the first nine months of 1936 carried 740,238 passengers which compares impressively with the 860,871 passengers carried all of last year both on domestic airlines and American-owned lines with foreign extensions. Indications are that the 1936 figure will go well beyond the million mark when final tabulations are in.

September traffic reached 102,239 passengers on 22 companies operating during that month. This compares with 77,370 passengers carried on 24 lines operating in September, 1935. The 22 airlines flew 5,756,363 miles, carried 652,930 pounds of express and reported that 70.45% of available seats were used. Express poundage in September showed a sizeable increase over August, 1936 figures and a slight increase over July, 1936.

* * *

Continued record-breaking traffic on United Air Lines featured the first nine months of the current year when the company carried 163,000 revenue passengers, 1,620,410 lbs. of express and 4,334,771 lbs. of mail. United's fleet of 50 planes flew 12,040,081 miles during the period, a 10% increase over the corresponding part of 1935.

* * *

Inauguration during September of Douglas four-stop coast-to-coast service and accelerated service between New York and Chicago and other points on its route, resulted in a boost in passenger traffic which helped American Airlines show a 31.5% increase in traffic during the first nine months of 1936. The 175,549 passengers who flew with American Airlines were less than 500 of the total for the complete year 1935, when 176,005 passengers were carried. American's monthly average to the first of October has been 19,505 passengers this year compared with a monthly average of 14,667 passengers a month in 1935, a gain of about 33%.

Transcontinental & Western Air, Inc., reported an increase of more than 13,000 passengers, 100,000 lbs. of express and about 500,000 lbs. of mail for the first nine months of 1936 compared with the corresponding period last year. During the period in question, TWA carried 64,875 passengers, 1,568,260 lbs. of mail and 277,943 lbs. of express and flew 55,272,452 passenger miles. Expressed in percentages these gains, respectively are: 25.37, 38.57, 56 and 13.5.

* * *

Northwest Airlines established a record of 10,412,156 passenger miles for the first eight months of this year during which period 24,014 passengers were carried. Present schedules of the company require that 11,627 miles be flown each 24 hours to accommodate the average daily mail load of 3000 lbs. and 110 passengers.

* * *

Ten-months report of Chicago & Southern Air Lines shows 2833 more passengers carried than during the entire year 1935 and 1106 passengers for October alone. This represents a 95% increase in number of passengers and a 164% increase in passenger revenue over October 1935.

* * *

Air express business for the eight months ending September 30 showed an increase of 66% over that of the Railway Express lines for the corresponding period of 1935. Shipments during September set up a new high when 43,153 packages were flown compared with 37,790 in August.

* * *

Commercial airline passenger traffic at Love Field, Dallas, set an all-time record during October when transports carried 2963 passengers into and 3000 out of the field. This total exceeded the previous record set in August, 1935.

THE INDUSTRY

Production Increase

Aircraft and aircraft engine production and deliveries during the first eight months of 1936 exceeded those of the similar period of 1935 by substantial margins, according to reports of the Aeronautical Chamber of Commerce. During the period, 1026 commercial airplanes and 609 military craft were produced, the total value of both classes being $18,616,342. This compares with a total production during the first eight months of 1935 of 887 units valued at $12,447,199.

Engine production up to August 31, 1936 reached 2759 commercial and military units valued at $14,335,837, as compared with 1684 units worth $7,515,458 for the comparable period in 1935.

Total valuation of military and commercial aircraft and engine production was $32,952,179, compared with $19,962,657 for 1935.

Airplane spare parts delivered during the first eight months of 1936 totaled $5,249,583 and engine spare parts delivered totaled $4,174,836. Both are substantial increases over comparable figures of 1935.

* * *

Arrow Aircraft Corp. is now in production on the V-8-powered low-wing monoplane and three of these planes already have been delivered. Distributors have been appointed in various parts of the country, one of which—Arizona Aviation Service, Inc., of Tucson has ordered 24 planes. Other distributors for the Arrow Sport will be Lieut. Welpton, for the state of Iowa; George Bonning, Detroit; and G. D. Kelsey, Philadelphia.

New Dealers

Charles Howard and Marshal George are now sales representatives for the new **Howard Special** on the West Coast, with headquarters at San Francisco Airport.

* * *

Nicholas-Beazley and Air Associates are handling the aviation sales of the Pierce Chronograph, the watch that combines the functions of a wrist-watch, stopwatch, tachometer and telemeter.

* * *

Distributorship of the 1937 series of Ryan S-T planes in the New York and New England territory has been secured by O. J. Whitney of North Beach, N. Y., who ordered five planes, three for immediate delivery.

$15,882,287 Exports

Value of aeronautical products exported from the United States through September, 1936 was more than 42% ahead of that for the same 1935 period and almost 11% better than the full year 1935. During the first nine months of 1936, there were exported 372 aircraft, valued at $8,065,939; 616 engines, ($3,358,957); $265,072 worth of parachutes and $4,192,319 worth of parts and accessories, bringing the total to $15,882,287 not including exports to our noncontiguous territories which raised the total to $16,157,308 which compares with $11,224,399 for the first nine months of 1935.

Best customer thus far in 1936 is China which imported $6,064,830 worth of American aeronautical products. Argentina purchases accounted for $1,485,641 worth of American products while other sizable purchases were made by buyers in The Netherlands, $739,266; Canada, $518,259; Australia, $489,879; Japan, $479,573; Siam, $461,616.

The Ryan S-T Comes East

O. J. WHITNEY, INC.

Announce their recent appointment as Ryan distributors for New York, Northern New Jersey and New England. Dealerships in these territories are now open.

Two of these beautifully modern ships are waiting at North Beach for you to fly yourself. They will be used for demonstration, rental and instruction purposes and will be supplemented soon by three more.

The most popular ship on the West Coast, it is destined to enjoy the same reputation in the East within a very short time.

A representative will gladly call and demonstrate to prospective dealers in territories mentioned above. Prompt delivery is now possible.

O. J. WHITNEY, INC.

North Beach Airport
Phone: NEwtown 9-0300
JACKSON HEIGHTS, N. Y.

Are you worried about Fabric Durability in freezing temperatures?

Then use

FLIGHTEX FABRIC

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SUNCOOK MILLS
34 Thomas St., New York, N. Y.

New Ryans

Refinements and improvements characterizing the 1937 series of Ryan S-T planes include the new lever-type direct-acting wing flap control. This device replaces the former small sprockett-type hand crank formerly on the floor of the rear cockpit. The new lever, of polished chrome metal at convenient stick handle height, is now at the right of the fuselage. A thumb spring grip release and position lock permits instantaneous placing of the lever at any of five stations, allowing the pilot to lower or raise the flaps to any desired position.

A recent decision of the manufacturers to finance the sale of its planes on terms comparable to accepted plans in the automobile business provides for payments of ⅓ the purchase price, with balance, including cost of insurance and finance charges, payable in twelve monthly installments.

ATC's Issued

Stinson Aircraft Corp., model Stinson SR-8D, 5-place cabin landplane; 285 hp Wright Whirlwind R-760 E-1. (ATC 609)

Fairchild Aviation Corp., model "24" C8F, 3-place cabin landplane; 145 hp Ranger 6-390D. (ATC 610)

Seaplane approvals to Taylor Aircraft Corp., model J2 with Edo 1070 floats; to Fairchild "24" and Stinson SR-7 and SR-8 on Edo model 4000 floats.

Porterfield Aircraft Corp., model 35W, 2-place cabin monoplane; 90 hp Warner Scarab Jr. (ATC 611)

Howard Airplanes, model DGA8, 4-place cabin monoplane; 320 hp Wright Whirlwind R760E-2. (ATC 612)

Aeronautical Corporation of America, model Aeronca LC, 2-place cabin monoplane; 90 hp Warner Scarab Jr. (ATC 614)

Beech Aircraft Corp., model Beechcraft C17E, 4-place cabin biplane; 285 hp Wright Whirlwind R760E-1. (ATC 615)

Kinner Airplane & Motor Corp., Ltd., model B2R, 2-place open monoplane; 160 hp Kinner R-5 Series 2. (ATC 617)

Douglas Aircraft Corp., model DC-3, 24-place cabin monoplane; two 850 hp Wright Cyclone GR1820G-2. (ATC 618)

Engines

Wright Aeronautical Corp., model GR-1820F-56, 9-cylinder, radial, air-cooled; rated 745 hp at 2100 rpm at 11,300 ft.; model SGR-1820F-56, rated 730 hp at 2100 rpm at 11,300 ft. (ATC 159)

Pratt & Whitney Aircraft, Inc., model Twin Wasp S2A4-G, 14-cylinder, radial, air-cooled, rated 830 hp at 2400 rpm at 3800 ft. (ATC 160)

Continental Motor Corp., model W-670K, 7-cylinder, radial, air-cooled; rated 225 hp at 2175 rpm. (ATC 162)

Pratt & Whitney, model S2H1 Wasp, 9-cylinder radial air-cooled, rated 500 hp at 2200 rpm at 10,500 ft. (ATC 163)

Pratt & Whitney, model Hornet S5E, 9 cylinder radial air-cooled, rated 700 hp at 2050 rpm at 6000 ft. (ATC 164)

Personnel Notes

Arrow Aircraft Corp. has employed Edward Hedlar, formerly of the Bendix Corp., and Capt. Nelson Story III who will be assistant sales director.

* * *

H. Richard Alexander and Stephen Rolle, formerly of the U. S. Navy Dept., Naval Aircraft Factory, have joined the engineering staff of Kinner Airplane & Motor Corp., Ltd. Both will be employed in engine work.

* * *

New vice-president of Westinghouse Electric & Mfg. Co. is Davis S. Youngholm who will headquarter in New York.

* * *

Joseph Crosby recently joined the Development and Sales Division of Thiokol Corp., manufacturers of oil-proof synthetic rubber.

* * *

Succeeding Wm. F. Wise, Thor M. Olson has been appointed sales manager of the Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.

Coming Events

"Aviation in Industry" Exhibition; International Building, Rockefeller Center, N. Y., N. Y., sponsored by AERO DIGEST. Dec. 1-31

●

Aircraft Show, Miami Municipal Airport, Miami, Fla. Dec. 6-12

●

"Cub Convoy" for Miami Air Races takes off from Atlanta, Ga. Dec. 8

●

Ninth Annual Miami All-American Air Maneuvers, Municipal Airport, Miami, Fla. Dec. 9-12

Miami-Havana Air Race. Sponsored by Cuban National Tourist Commission and City of Havana. Dec. 13

●

National Aviation Show, auspices Aviators' Post 743, American Legion, Grand Central Palace, New York. Gus Parsons, managing director. Jan. 28-Feb. 6, 1937

●

Second Annual National Pacific Aircraft and Boat Show, Pan-Pacific Auditorium, Los Angeles, Calif. Cliff Henderson, managing director. Mar. 13-21, 1937

Expansion

Security National Aircraft Corp., is building a new factory on a site adjoining the Long Beach, Calif., Municipal Airport. The first unit of the new plant will contain 60,000 sq. ft. of floor space and this will be followed by a second unit with 20,000 sq. ft. The factory is expected to be ready for production in February.

* * *

Buildings at Farmingdale, L. I., New York have been sold to Ranger Engineering Corp., which has taken title to the unit it now occupies, and to Seversky Aircraft Corp., which has also bought the plant it now occupies as well as that occupied by Grumman Aircraft Engineering Co. Grumman will move to Beth Page, Long Island. Arrangements have been completed whereby Ranger and Seversky will jointly use the Farmingdale Field.

* * *

Lockheed Aircraft Corp., has just completed two new one-story brick buildings—one a paint shop with 1140 sq. ft., and the other a 1125-sq. ft. tubing shed. The assembly department also was expanded by the addition of a hangar of about 9200 sq. ft. floor space.

Interior view of Nicholas-Beazley's new headquarters at Floyd Bennett Field, Brooklyn, N. Y.

Expanded facilities are now available at the new location recently taken by Nicholas-Beazley Airplane Co. at Floyd Bennett Field, New York. More floor space enables larger stocks, better display of the goods, and more expeditious service for customers.

New Companies

Providence Engineering & Manufacturing Co., Tekamah, Neb. Capitalization $25,000. Incorporators Harry Williams, Floyd Tobin, Warren E. George, George Nelson, Thomas J. Sheehan, Jr., to conduct manufacturing and dealerships in aircraft and other mechanical devices.

Oil Belt Air Lines, Love Field, Dallas, Tex. Operators M. Mathewson, J. A. Maxwell flying Stinson tri-motored craft between Dallas and Gladewater.

Nebraska Aircraft Corp., Ogallala, Neb. Capitalization $5000. R. E. Searle, P. H. Searle, M. M. Maupin, incorporators.

Burgard Aviation Corp. No. 3, Inc., Buffalo, N. Y. Capitalization $5000. King Donaldson, Robert Volgenau, Clyde Carver, incorporators.

Argonaut Aircraft Co., Inc., Buffalo, N. Y. Capitalization $300,000. L. W. M. Zingler, Maurice Brothman, J. P. Jordan, incorporators.

Taylorcraft Aviation Co., Alliance, Ohio. Capitalization $45,000; 1800 shares no par stock. Incorporators C. G. Taylor, S. L. Geiger, A. W. Tibbits. Aircraft manufacturing business.

The Aircraft Exchange, Inc., Seattle, Wash. Capitalization $50,000. Incorporators B. Bryant, M. Borisoff, Paul R. Johnson. Aircraft manufacturing and transportation business.

Leonard J. Schrader & Co. (Aviation Division), South Bend, Inc. Leonard J. Schrader, presi-

(Continued on following page)

Thanks to You—

1936 WAS A GOOD YEAR FOR AERO SUPPLY

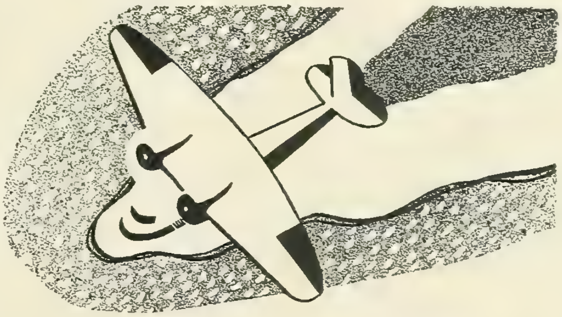
AS another year draws to a close and we "compare notes" with 1935 and previous years, we cannot withhold an expression of pleasure over what we find. Especially when one considers that the growth of AERO SUPPLY'S business depends upon conditions affecting the aircraft manufacturers and operators throughout the industry. Our attitude toward the coming year, consequently, is of the most optimistic nature. In looking forward to a continuation of your patronage next year, we are constantly reminded of our mutually pleasant relations this year and in the past. May they multiply as time goes on!

AERO SUPPLY

MANUFACTURING CORPORATION

FOR SAFETY IN THE AIR

CORRY, PENNA.



NON-CORROSIVE . . .

Practically immune to atmospheric corrosion and salt water attack—because there's no protective surface to wear out. These cables are chrome nickel alloy steel throughout. Inspection cut down—no danger of hidden corrosion in inside wires. Macwhyte PREformed construction increases flexibility and resistance to fatigue—reduces internal stress and friction.

● Three constructions—1 x 19 (non-flexible), 7 x 7 (flexible), 7 x 19 (extra flexible). Also tinned and galvanized. Made to conform with Army-Navy specifications. Write for descriptive folders.

MACWHYTE stainless steel *PRE*FORMED aircraft cable

used by leading aircraft manufacturers, airlines and repair stations

AD NO. 229

MACWHYTE COMPANY
Dept. AD-12 Kenosha, Wisconsin

MAKERS OF TIE RODS, BRAIDED SLINGS AND CABLE FOR AIRCRAFT

(Continued from preceding page) dent. Bonded fly-away delivery service, new and used plane brokerage and sales.

Air Radio, Chicago Municipal Airport. H. T. Sagert. RCA aviation radio sales, service, rental; public address systems, sales and rental.

Hubert & Dillon Air Service, Inc., Tacoma, Wash. Incorporators E. A. Dillon, L. W. Hubert, F. A. Feutz. General aircraft service.

Exhibits and Shows

Aero Digest is again sponsoring an exhibition in the International Building, Rockefeller Center, N. Y. Known as "Aviation in Industry," the exhibit is occupying the Metals and Plastics Bureau gallery from Dec. 1 to Dec. 31, and is intended to acquaint engineers, scientists and industry in general with the technical advances made in aeronautical manufacture in recent years; and to promote confidence on the part of the flying public in the suitability of aeronautical materials.

A partial list of exhibitors includes the following: Airplane & Marine Direction Finder; American Airlines; Bartow Beacons; Berry Bros.; B. G. Corp.; Cambridge Instrument Co.; Champion Spark Plug Co.; L. C. Chase & Co.; Cleveland Pneumatic Tool Corp. (in conjunction with Republic Steel); Climax-Molybdenum Co.; Curtiss-Wright Corp.; Dardelet Threadlock; Edo Aircraft Corp.; Elastic Stop-Nut Corp.; Ex-Cello-O Aircraft & Tool Corp.; Fafnir Bearing Co.; Federal Laboratories; Fisher-Coulter Labs.; General Tire & Rubber Co.; B. F. Goodrich Co.; Goodyear Tire & Rubber Co.; Hamilton-Standard Propellers; Haskelite Mfg. Corp.; Irving Air Chute Co., Inc.; International Nickel Co.; Marlin-Rockwell Corp.; Pratt & Whitney Aircraft; Pump Engineering Corp.; Pure Oil Co.; Radio Navigational Instrument Corp.; Ranger Engineering Corp. (Fairchild); Reading Batteries, Inc.; Republic Steel Corp.; Switlik Parachute and Equipment Co.; Safetee Glass Co.; Sherwin-Williams Co.; SKF Industries, Inc.; Solar Aircraft; Sperry Gyroscope Co.; Summerill Tubing Co.; Thiokol Corp.; Timkin Roller Bearing Co.; U. S. Dept. of Agriculture, Weather Bureau; Union Carbide Corp.; Western Electric; Weston Electrical Instrument Co.; United Airlines; World-Telegram; Wright Aeronautical Corp.; Wyman-Gordon Co., Fairchild Aerial Surveys; Electric Storage Battery; Bellanca Aircraft Corp.; Gulf Refining Co.; and Magnaflux Corp.

Admission to the gallery is free and the exhibits, many of which are of the animated type, will be on view to the public from 10 am to 6 pm weekdays, except Saturday, when the closing hour is 3 pm.

* * *

Ten weeks before opening of the National Aviation Show which will be held in Grand Central Palace, N. Y., N. Y. from Jan. 28 to Feb. 6, more than 60 aeronautical organizations and interests have contracted or applied for space. These include: *Aero Digest;* Aero Engineering Corp.; American-LaFrance and Foamite Industries, Inc.; Argonaut Aircraft Co., Inc.; Arrow Aircraft & Motors; Aviation Mfg. Corp.; Bellanca Aircraft Corp.; Bendix Aviation Corp.; Bendix-Cowdrey Brake Tester Inc.; Bendix Products Corp.; Bendix-Stromberg Carburetor Co.; Bendix-Westinghouse Automotive Air Brake Co.; Berry Brothers; Breeze Corp.; B. G. Corp.; Boeing Aircraft Co.; Casey Jones School of Aeronautics; Chance Vought Aircraft; Cities Service Corp.; Continental Motors Corp.; Curtiss-Wright Corp.; Early Birds Association; Eclipse Aviation Corp; Edo Aircraft Corp.; Fairchild Aircraft Corp.; Fleetwings, Inc.; Gulf Refining Co.; Gwinn Aircar Co., Inc.; Hamilton Standard Propellers; Inter Continent Corp. (Vultee Airplane); Jacobs Aircraft Engines; Junior Birdmen of America; Kendall Oil Co.; Kinner Airplane & Motor Corp.; Kollsman Instrument Co., Inc.; Link Trainer; Luscombe Airplane Development Corp.; New York University; Nicholas-Beazley Airplane Co., Inc.; Pan American Airways; Pioneer Instrument Co., Inc.; Porterfield Aircraft Corp.; Pratt & Whitney Aircraft; Radio Navigational Instrument Co.; Ranger Engine Co.; Railways Express Agency (Air Express Div.); RCA Mfg. Co., Inc.; Rearwin Airplanes Inc.; Roosevelt Aviation School; Scintilla Magneto Co., Inc.; Sensenich Bros.; Seversky Aircraft Corp.; Shell Petroleum Corp.; Sikorsky Aircraft; Sinclair Refining Corp.; Sperry Gyroscope Co., Inc.; Stewart Technical School; Standard Flying Service Inc. (Taylorcraft); Standard Oil Co.; Stinson Aircraft Corp.; Suncook Mills; Taylor Aircraft Co.; Teicher Mfg. Corp.; The Texas Co.; Transcontinental & Western Air Inc.; United Aircraft Corp.; United American Bosch; U. S. Bureau of Air Commerce; Waco Aircraft Co.; Walter Kidde & Co.; O. J. Whitney, Inc.; McLaughlin Aerial Surveys.

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Textbook on Aviation

A well-rounded course, suitable in preparing for any grade of license. This recently revised simple and direct, semi-technical, popularly priced publication is extensively illustrated and in its new size (7" x 9") presents the most modern aeronautical text material available for schools and operators.

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Volume 1. History of Aviation, Aerodynamics, Theory of Flight and Glossary.
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Volume 3. Engines, Ignition, Carburetion and Starters.
Volume 4. Navigation, Meteorology, Radio Beam and Orientation Procedure.

Glendale, Calif. — Marshall, Mo. — Brooklyn, N. Y. — Dallas, Tex.

NICHOLAS-BEAZLEY

TAKE SANTA ON A *Vacation* AT
Chalfonte-Haddon Hall

This year the calendar presents you with a three-day week-end for Christmas . . . and these beachfront hotels offer an old-fashioned holiday time to match it. Stockings for the youngsters, gifts for the grown-ups, carols for all round the Haddon Hall tree.

Bring riding clothes and skates. Your golf clubs too. You'll need to work up a huge appetite for the festive meals we've planned (special care given diets). Game rooms, concerts, varied entertainment. Ocean Decks, health baths — everything, indeed, to build you up for the rigors of winter ahead.

LEEDS AND LIPPINCOTT COMPANY
ATLANTIC CITY

DIGEST OF RECENT EVENTS

Mollison Sets New Sea Record

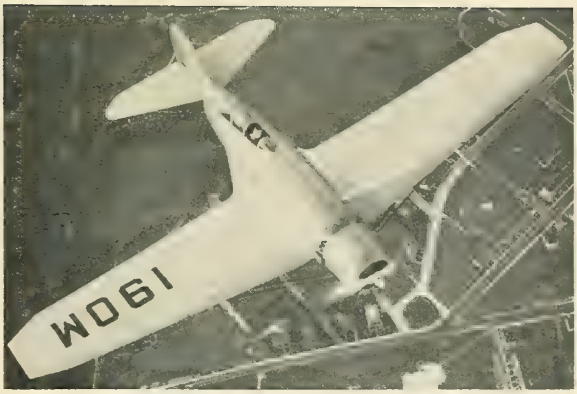
Captain James A. Mollison completed his third aerial crossing of the North Atlantic when he landed at Croydon Airdrome 13 hours and 17 minutes after his take-off from Harbor Grace, Newfoundland. Mollison's time beat Amelia Earhart's 14-hour 54-minute crossing in 1932. Mollison flew the Pratt & Whitney powered Bellanca Flash, "The Dorothy", a low-wing monoplane with retractable landing gear and Hamilton Standard controllable-pitch propeller. OCT. 30

Dr. Brock Completes 7th Year of Daily Flights

Dr. John D. Brock completed his 2556th day of consecutive flying at Fairfax Airport, Kansas City. Every day for seven years, Dr. Brock has made at least one flight, regardless of its duration and irrespective of weather conditions. NOV. 15

Paris-Hanoi Mark Set By French Pilot

André Japy, making a flight from Paris to Tokyo, established a new record between Paris and Hanoi, arriving there in 51 hours as against 140 hours, the previous best mark. Flying non-stop from Paris to Damascus, 2200 miles, Japy negotiated the trip in 14 hours. He expected to reach Tokyo, 10,000 miles from Paris, in less than four days. NOV. 18.



Bellanca "Flash" flown across North Atlantic by Mollison

Business Reports

United Aircraft Corp. directors declared a dividend of 50¢ a share on its capital stock and also announced wage increases and adjustments which in the coming year will add $635,000 to the income of their hourly wage employees. Dividend is payable Dec. 15 to stockholders of record at the close of business Dec. 1. Hourly rate employees at Pratt & Whitney, Chance Vought, Sikorsky, Hamilton Standard and United Airports will receive immediately a flat wage increase of 5¢ per hour, and commencing next year, vacation with pay.

United's net profit for the quarter ended Sept. 30 was $364,189 and for the nine months ending Sept. 30, $912,749.

* * *

Net loss of $40,142.48 for the nine months ended Sept. 30, 1936 was reported by Waco Aircraft Co. after deductions. Net manufacturing profit for the period was $132,968, with sales netting $830,080.89.

* * *

Aviation Corp. reported a net loss of $115,896 for the nine months ended Sept. 30 and a net profit for the third quarter of $58,374. Net loss for the first six months of the year was $174,270.

Consolidated net profit of $131,712.42 for the first nine months of the year, after deductions for federal normal income tax but before provision for federal surtax or undistributed profits was announced by Boeing Airplane Co. This compares with a loss of $591,993.93 for the same period last year.

* * *

Largest backlog in the history of the company was announced by Lockheed Aircraft Corp., with unfilled orders on hand totalling $1,250,000. Net profit for the first half of the year was $40,213.32.

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FOREIGN ACTIVITIES

Brazil Buys 30 Whirlwind-Powered Stearman Trainers for Its Army

● An order for 30 Wright Whirlwind powered Model 76-C3 high-performance advanced training and expeditionary airplanes, the latest version of its military trainer series, has been awarded to The Stearman Aircraft Co., by the Brazilian Army Aviation Dept.

Providing the Brazilian Air Corps with the most up-to-date equipment, the new planes will be readily adaptable to a variety of purposes, including long range observation, aerial photography, scouting, attack bombing, and advanced training. Deliveries of the first lot (5) are scheduled for March, 1937.

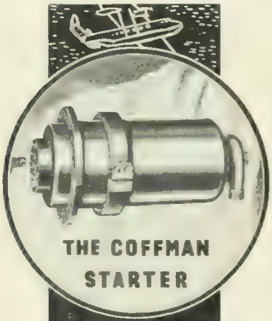
The contract involves a total of $585,000. The new Brazilian planes make a total of more than 200 equivalent airplanes of the Stearman primary and advanced trainer series ordered in the past two years for various air forces of the world, including the U. S. Army Air Corps, the U. S. Navy, the Philippine Army Air Corps and the Argentine Naval Aviation Service, which recently received a fleet of Stearman 76-D1's, similar in general design to the planes now on order for Brazil. Among the recent orders have been a U. S. Army Air Corps contract for 50 of the Stearman primary trainers to supplement thirty others previously ordered, and a new contract for both primary and advanced trainers for the Philippine Army Air Corps.

Special features of the Stearman 76-C3's for Brazil include alternate provisions for the installation of two-way radio and aerial camera equipment. Provision is also made for the installation of both a fixed and a flexible machine gun and bombing equipment. Provision will be made for night flying equipment, navigation and landing lights, and blind flying hoods.

Structural design of the plane conforms to the requirements for military planes of the U. S. government air services. It is a two-place biplane with welded steel tube fuselage, fabric covered; tail surfaces of welded steel tube, fabric covered with wire bracing; and wings of spruce spars and ribs, fabric covered. The airplane embodies the latest refinements of aerodynamic design, including modified NACA ring cowl and full cantilever oleo shock absorber landing gear, equipped with hydraulic brakes. The tail wheel is full swivelling and steerable.

Equipped with the Wright R975-E3 engine developing 420 hp at sea level at 2200 rpm, the 76-C3 will have a maximum speed of 166 mph, landing speed of 59 mph, service ceiling of 18,200 ft., and will climb at the initial rate of 1190 ft./min., or to 10,000 ft. in 13½ minutes. With a fuel capacity of 100 gals. and 7 gals. of oil, it will have an endurance at operating speed of 3 hrs. 45 minutes.

Wing span will be 32 ft. 2 in.; overall length, 24 ft. 4.87 in.; overall height, 9 ft. 1.87 in. The plane will have an empty weight of 2420 lbs. and a gross weight (with full load) of approximately 3700 lbs. contingent upon special equipment desired by the customer.



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FOREIGN NEWS IN BRIEF

Australasia

Fourteen subsidized and 11 unsubsidized services carrying passengers, mail and express and 4 unsubsidized services carrying passengers and express were in regular operation in Australia September 1, 1936. The subsidized passenger, mail and express services, using 19 planes (15 British, 4 American) are operated over 10,913 miles over which the planes are scheduled to fly 44,594 miles a week. The unsubsidized services, using 14 planes (12 British, 2 American) over 4928 miles, are scheduled to cover 41,416 miles a week and the unsubsidized passenger and express services, using 4 planes (3 British, 1 American) over 935 miles, fly 3030 miles a week.

Airlines of Australia Ltd., purchased the assets and are taking over the operation of the two services of Rockhampton Aerial Services Ltd. One service, a round trip a week, is 330 miles between Rockhampton and Mt. Coolon via Clermont. The other service is maintained weekly over the 325-mile route between Brisbane and Rockhampton.

Records for commercial flights between Sydney and Brisbane were broken when a Guinea Airways Lockheed *Electra* made the trip in 2 hours 27 minutes, and again when an Airlines of Australia *Stinson,* carrying 8 passengers, flew the route in 2 hours 20 minutes.

Australian National Airways Ltd., has purchased an additional 14-passenger Douglas for the Adelaide-Perth run.

Canada

Royal Canadian Air Force is now receiving new equipment recently purchased in Britain at a cost of more than $500,000. Two of seven *Shark* bombers have been delivered and are now being assembled at Rockcliffe Airdrome. The other five are on the way. The bombers are latest types and have a maximum speed of 175 mph and a 7-hour duration.

In addition to the bombers, 10 Fleet trainers for the R. C. F. C. are under construction.

Eastern Canada Airlines has applied to the Civil Aviation Branch for a license to operate a freight and passenger service between the principal cities in the Maritime Provinces. Five planes to be used in the proposed services were especially designed for freight work and were built by General Aircraft Co. in England.

Statistics which illustrate a tremendous growth in recent months of aerial freight traffic, have been issued by Canadian Airways. During September, this company transported more than 1,000,000 lbs. of freight in the midwest mining area alone, an unprecedented achievement and a total for one month which is nearly 25% higher than the company's aggregate load for the entire year 1931.

A useful experiment made by Canadian Airways during the summer which may lead to further developments next year was the dusting of pea fields containing plants that had been attacked by aphis. A biplane of the company's fleet was fitted with special hoppers and venturi discharge, and Pilot M. McGregor was detailed for the work. First tests were made using nicotine dust. With the plane flying at 10 ft., the dust made a swath 30 ft. wide on the ground.

The hoppers are fitted into the forward mail compartment of the plane, and hold 650 lbs. of nicotine sulphate. Each has a separate vent pipe connecting with the main venturi, and each vent is controlled from the cockpit.

Experience showed that the best speed at which to operate from a height of about 10 ft. was 85 to 90 mph. On July 28, 650 lbs. of dust were spread on a 20-acre field in 30 minutes and on a second trip another field of equal size was treated as quickly. The total area dusted from the air was 75 acres.

Regular winter air mail service along the north shore of the Gulf of St. Lawrence in Quebec will operate this year from Rimouski instead of Quebec and will be extended from Natashquan to Harrington Harbor. Start of the flights is dependent on closing of

(Continued on following page)

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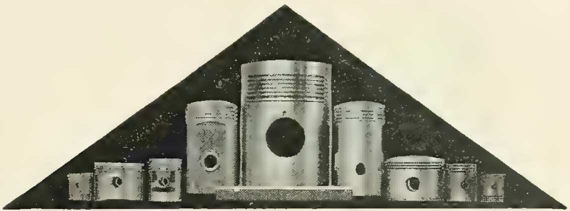

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(Continued from preceding page)

other forms of navigation, but is expected to be about the middle of this month.

Other mail services, these scheduled to start about Jan. 10, are between Ft. St. John, N. B. and Ft. Grahame, and Ft. Nelson

Canadian Car and Foundry Co., Ltd., largest railway equipment manufacturers in the Dominion, will build Grumman and Burnelli aircraft under manufacturing rights recently negotiated.

L. A. Peto, vice-president and general manager, states that in view of the fact that the majority of the British factories and also those in the United States, are working to capacity on equipment for their respective governments, Canadian Car has decided to take advantage of the situation, and to attempt to meet the requirements of those countries which have heretofore been dependent upon production in Britain and the U. S., and, owing to congestion in these countries, are not able to get adequate service at this time.

With the formation of the new Department of Transport on Nov. 2, the Civil Aviation branch of the Department of National Defence has been transferred to the Department of Transport. Comdr. C. P. Edwards, formerly director of radio, Department of Marine, is now chief of air services, which include civil aviation, radio and the meteorological services. J. A. Wilson remains as controller of civil aviation under Comdr. Edwards.

D. P. Mowry was elected president of the Montreal Light Aeroplane Club Inc. for the balance of 1936 and for 1937. Other officers are Alex Graydon and Dr. Rene Simar, vice-presidents; Leslie Choyce, honorary secretary-treasurer; Capt. Geoff Beck, Frank Dougherty, William Couture, Stuart Webster, William Cooke and Dean Nesbitt, directors.

To replace instructor Ken Main, who has become an assistant inspector of civil aviation, the Toronto Flying Club has employed Ray Goodwin, formerly instructor at Sydney, N. S., Flying Club.

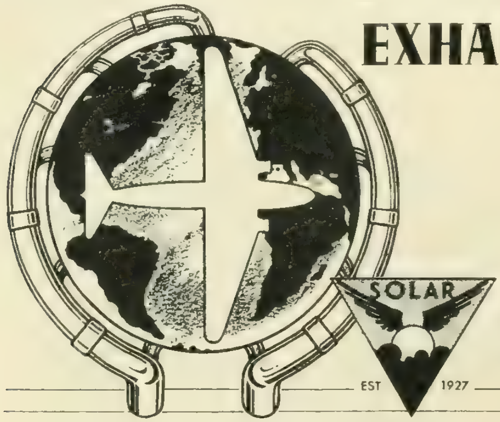
Wright Whirlwind powered Stinson Reliant on Edo floats for service in Canada

Anticipating early establishment of the trans-Canada airway, the Canadian government is working on detailed plans for a semi-private company to carry mail and passengers on the main route. It is expected that arrangements will be such that there will be no duplication of routes across the continent. Northern feeder lines and similar feeders to connect with United States lines at various points, are planned—all to be operated by the partly government-owned company.

A Taylor *Cub* has been purchased by W. B. Darby, Hudson, Ont., representative for J. S. Innes, Ltd., contractors for mining machinery, tractors, mine supplies, etc. Darby's territory extends 900 miles northwest of Toronto and he will use the plane to cover his far-flung territory throughout Canada.

Cuba

The Cuban Government has provided for the reestablishment of a Commission for Aeronautics which will "study and report on the various legal problems which frequently arise relating to civil aerial navigation." The Commission will be attached to the Bureau of Civil Aeronautics of the Aviation Section of the Army General Staff, and will be composed of five members chosen by the Chief of the Army (2), Chief of the Navy (1), by the Secretary of Communications (1),



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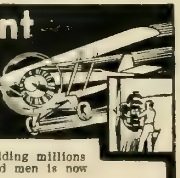

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Taylor Cub which will be flown by W. B. Darby in covering his sales territory in Canada

and the fifth will be a technical employee of a civil aviation company.

Denmark

There is one commercial aviation company in Denmark—The Danish Air Transportation Co., which maintains scheduled operations serving Copenhagen, Oslo, Stockholm, Gothenburg, Malmo, Hamburg, Berlin, Paris, Brussels, Amsterdam, Rotterdam, and London in cooperation with Swedish, German, Dutch, and British companies.

Civil aviation, except scheduled air transport services, has developed slowly in Denmark. There has, however, been an increasing interest in flying in the last few years. While there were 10 privately-owned planes licensed in 1930, the number increased to 23 by the latter part of 1935. Of this total, 5 were transport planes in scheduled service, 10 were used for sightseeing trips, training, photography, etc., 1 was for advertising purposes, and 7 for sport flying.

France

Air France planes during August flew 574,653 miles while carrying 8332 passengers, 64,935 lbs. of mail and 110,138 lbs. of express. Traffic was slightly under the previous month, particularly in express and mail volume.

All airplanes exported from France, regardless of country or origin, or country of destination must receive the approval of the Ministry of Air. Exception is made of planes with engines of less than 150 hp. In such cases export permits are not required.

The French Air Ministry is now nationalizing all aircraft manufacturing concerns supplying the Government. As a first step in this direction, four companies have been formed for the construction of airplanes and seaplanes with a capital provided two-thirds by the State and one-third by private interests. Each company takes over aeronautical manufacturing firms in one of the four districts into which the whole of France has been divided. These concerns will be expropriated, compensation being made by the Government through the purchase of stock and equipment, similar to its relation with Air France in which company it owns 51% of the common stock.

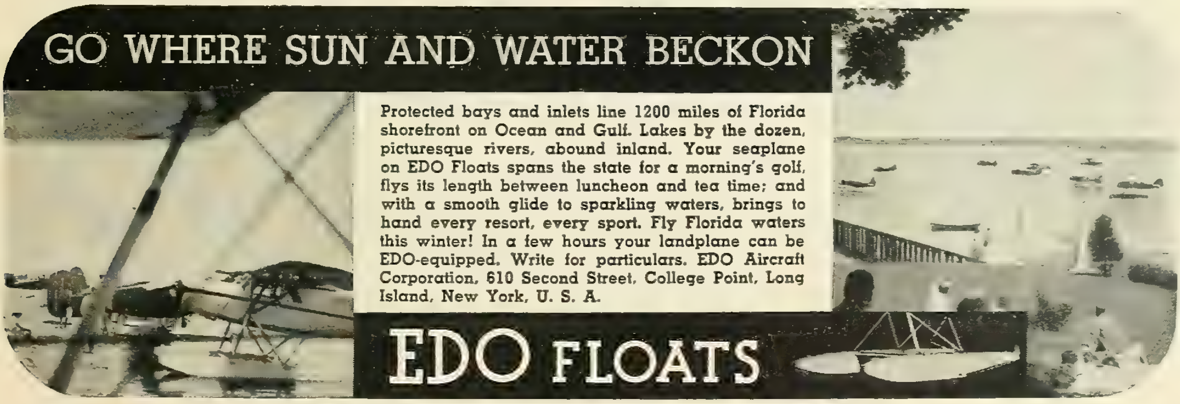
Great Britain

Foster, Wikner Aircraft Co., Ltd., has developed a two-place, high-wing monoplane powered by a converted Ford V-8 engine. Of all-wood construction, the plane, known as the *Wicko*, has a maximum speed of 115 mph, cruises at 100 and lands at 50 mph. Provision is made for 45 lbs. of baggage and for 13 gals. of fuel sufficient for a 250-mile cruising range. Gross weight is 1700 lbs. of which 530 is useful load. The engine delivers 85 hp at 3500 rpm, with reduction gearing set at 2.3:1.

An order for 200 Aeroncas has been received by the Aeronautical Corporation of Great Britain. Announcement to this effect by the corporation adds that production will shortly be at the rate of five planes a week. Production arrangements have now been completed at the Peterborough factory for an increased output of these planes, working up to 15 a week by next March.

First bomber to be built in one of the new factories set up to meet the needs of the Royal Air Force expansion program, the Fairey *Hendon* monoplane is now in production at Stockport, Lancashire. The first machine built has been delivered to the Air Ministry and others are following at regular intervals. Chief

(*Continued on following page*)



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(*Continued from preceding page*) factor in choice of locality of the new works was the Air Ministry system of zones, under which building was encouraged of new factories in the west of the country, held to be less vulnerable to air raids than eastern districts.

The Hendon is a low-wing monoplane, with cantilever wings and enclosed cockpits.

Italy

A new service was recently inaugurated between Turin and Rome. Fiat APR 2 planes, all-metal, twin-engined transports, accommodating 8 passengers and crew, make the 323-mile trip in 2 hours. Considerable traffic is expected on this run which connects Turin with Rome, Europe, and the Orient. The trip costs $13.16 one way.

Japan

The large airport, known as the Fukuoka airport, was dedicated recently and is now open for use. The airport, at Gannosu beach, Shioya peninsula, in Hakata Bay, covers approximately 160 acres and is about 5 miles from the business center of Fukuoka. It is well sheltered from winds and currents and is considered an ideal site for long-range planes. Cost of construction was $146,650.

Russia

Construction has been started on a large airport in the district of Khimki, which is about 10 miles from Moscow. The field will be open for limited use next year and will be completed by 1940. It will cover 1367 acres and will connect with Moscow by the Leningrad and Volokolamsk highways as well as by two nearby railroads. In the vicinity of the projected airport will be three buildings to serve as ticket office and waiting room, hotel, and a rest home for aviation personnel. Plans call for an airport with facilities to take care of 720 passengers, despatch of 41 tons of freight, and 100 planes daily. It is to be an all-weather, year-around field with asphalt runways and radio facilities.

South America

Pan American Airways has secured permission to open an air transport service in the Panama Canal Zone between France Field on the Atlantic side and Albrook Field on the Pacific side. Service will be daily and operations are expected to start about the 15th of this month.

Customs airports for seaplanes and amphibions in the Dominican Republic are at Ciudad Trujillo, Azua, Barahona, San Pedro de Macoris, La Romana, Samana, Sanchez, Sabana de la Mar, Puerto Plata, and Monte Cristi; those for land planes are at Ciudad Trujillo, Barahona, Las Lajas, Dajabon, San Pedro de Macoris, La Romana, Villa Elias Pina (Comendador) and Azua.

A commission is to be named to organize a definite construction plan applicable to Rio de Janeiro's Calabuoco airport, and modify the city plan in that zone, in order that construction of buildings and other installations may commence in January 1937.

A bill has been presented to the Argentine Chamber of Deputies calling for appropriation of a sum sufficient to purchase six planes which, under the joint jurisdiction of the National Department of Hygiene and the Direction of Civil Aeronautics, would be operated for medical and hygienic purposes in the national territories of Pampa, Chaco, Rio Negro, Neuquen, Chubut and Santa Cruz. The planes would be used not only for periodic visits by doctors to outlying areas but, in emergency cases, would also serve to move patients.

The State of Minas Geraes (Brazil) has signed a contract with Panair do Brasil for the establishment of an air service between Rio de Janeiro and Bello Horizonte. This, which will be the first interior service by Panair, is expected to start about January 1, 1937, and will employ a 10-passenger, twin engine American plane for the daily round-trip service. Flying time is expected to be about 80 min. compared with 16 hours required by train.

Cia. Aeroposta Argentina, a French organization which has been operating from Bahia Blanca to Rio Grande, has been purchased by an Argentine company. It is understood that the new owners contemplate continuance of the present service and that service from Bahia Blanca to Buenos Aires will be added. The company also proposes services from Buenos Aires to Salta and to Asuncion (Paraguay).

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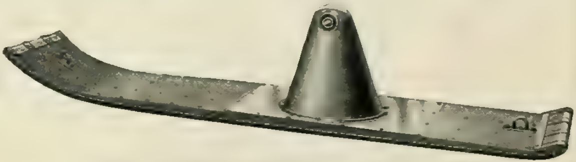

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ANTI-STATIC ANTENNAS

(*Continued from page* 36)

The same loop, oriented in the null position (with its plane at right angles to the source of signal) is used in conjunction with a radio direction finder aboard the airplane, which indicates the direction of the transmitting station by means of a left-right course indicator on the instrument panel. In this manner, the airplane is provided with means of utilizing the conventional radio range beacon courses under rain static conditions, and also with a navigational means of its own, permitting the pilot at all times to establish the exact position of his craft by cross bearings on two or more stations.

The United antenna, 18" in diameter, is mounted on the nose cap of the airplane in a fixed position. The metal shield structure is circular copper tubing; the gap is about ½". A switching arrangement is provided in the cockpit whereby the pilot may operate his receiver either from the loop or from United's usual V-type receiving antenna underneath the fuselage.

The unusual location of the loop was found to be most satisfactory. The electromagnetic field at this point is free from distortion, and there is no appreciable difference in the signal intensity whether the station lies ahead or behind. Still another advantage of this location is the fact that in flight a cushion of air is formed at the nose cap. The air flow near the loop is slower than along the fuselage, resulting in weaker impingement of rain, snow, and dust particles on the loop structure.

Consensus of opinion at present indicates that it is not likely that such loops will be enclosed within streamlined nacelles. However, subsequent experience may indicate such a form of construction. The air resistance is reduced to a minimum, and a loop may be more easily rotated within such a structure. On the other hand, it is believed that electrostatic charges will accumulate on the surface of the nacelle and set up an electromagnetic field which would interfere with the functions of the loop.

It is not expected that icing over of the loop structures will present special difficulties. A small amount of ice would not seriously affect reception, unless the ice contains a great number of particles of conductive matter, such as soot. If future operations indicate the necessity of making a provision for de-icing the gap, several methods are readily available to accomplish such an end.

Further technical information on this subject is contained in a paper by Howard K. Morgan, *Rain Static*, Proceedings of the Institute of Radio Engineers, Vol. 24, No. 7; 1936.

NAVY ACTIVITIES

(*Continued from page* 20)

struction has been recommended which will provide approximately 1910 airplanes by 1940-1942. Aircraft for the *Yorktown, Enterprise, Vincennes, Savannah, Nashville, Philadelphia* and *Brooklyn* are in the process of procurement and manufacture. Funds have been provided in the 1937 appropriation for new aircraft for VP Squadrons 17, 18 and 19 and the *Boise, Honolulu* and *Phoenix* and VF Squadron 44M. Funds are being requested in the 1938 budget for the new aircraft required for the *Wasp, St. Louis, Helena* and miscellaneous shore station increases.

Continued effort will be made to improve the characteristics of naval aircraft, particularly in regard to speed, range and striking power.

Development and employment of long range patrol planes as a potent striking force will continue. Patrol planes of increased range and striking power are in prospect.

The development of more powerful and more reliable engines is being continued which will further improve the performance of Naval aircraft, and further efforts are being made to increase the adequacy and efficiency of overhaul bases.

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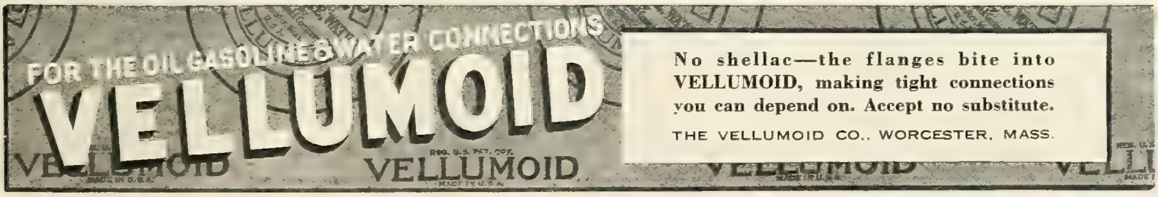

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STRATOSPHERE FLIGHT

(*Continued from page* 34)

them, and are prone to warp and stick. This problem of engine design is nearing solution. The excessively high rpm at which the turbine wheel rotates and the centrifugal forces set up, especially in the turbine buckets, must be overcome by metal which has been stressed at dull red heat. Engines have responded sluggishly to the throttle when equipped with a turbosupercharger, because the turbine wheel, though small, has such a great range of rpm that its inertia effect is great. Frontal area and consequent drag have been added to an airplane by a turbosupercharger, as parts of the installation, especially the turbine and coolers, must be exposed in the air flow to be cooled sufficiently for continuous operation. Installations have been complicated but it is now possible to gain somewhat of an advantage by a partial recessing of parts of the installation inside the engine cowling.

The turbosupercharger has an advantage in that it is not connected directly to the engine, its operation is flexible, and it has practically ideal control.

Geared centrifugal superchargers have also had certain troubles of an inherent nature, although these also have been somewhat alleviated recently. In this system, trouble has been encountered by the fact that the compressor is directly connected to the engine. Engine acceleration effects on the gear transmission and impeller often induced stress that caused failure. Even though the impeller is small, because of the high gear ratio involved, any sudden change in engine speed might induce stresses that have resulted in tooth failure or other damage. This has been overcome somewhat by interposing a friction clutch set to slip before damage is done. In this system a gain in critical altitude by increasing impeller diameter or speed, and its consequent inertia effects, would probably be prohibitive for the preceding reason. A gain might be obtainable by using present relationships and more than one stage. However, both courses are being pursued. A geared centrifugal supercharger can be installed without material effect on the drag of an airplane but if air coolers become necessary, the problem will be more like turbosuperchargers. The geared centrifugal type has a weight advantage over the turbosupercharger, but the method of control is not ideal. Engines equipped with this type of supercharger have been ruined by having the throttle control moved beyond its stop, for under-critical-altitude operation, and having the engine develop a greater horsepower than its rating while at low altitudes.

There is available a set of weights on installations of an identical nature where 400 hp engines were supercharged to critical altitudes of approximately 20,000 ft. A Roots and a turbocentrifugal installation weighed, including air ducts and mounting brackets, about 150 lbs. and 167 lbs. respectively.(3)

It might be concluded that the turbosupercharger appears to have greater theoretical possibilities than the geared centrifugal supercharger for operation at high critical altitudes. However, as far as practical or actual difficulties in the way of development are concerned both appear somewhat on a par. The answer as to what type of supercharger to use in adapting the present engine to conditions in the stratosphere probably cannot be definitely settled without further development.

(*To Be Continued*)

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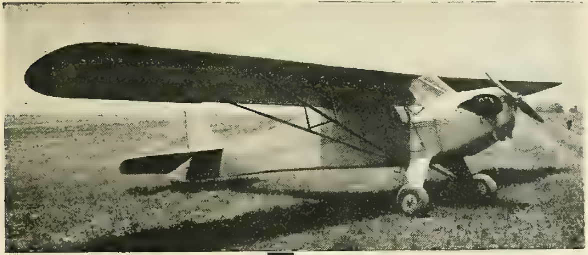

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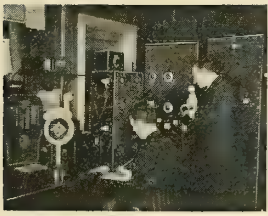

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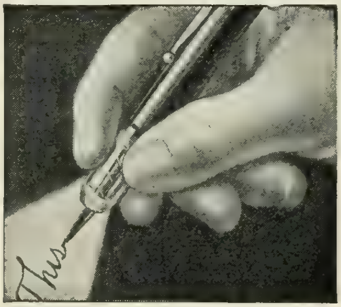

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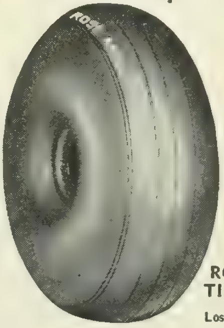

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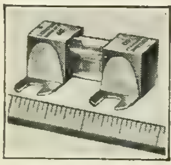

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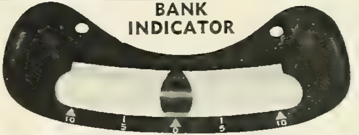

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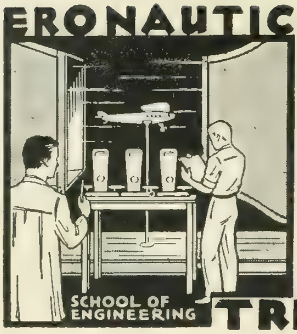

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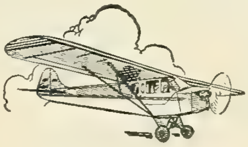

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Davis

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Fairchild

FAIRCHILD KR-31: 3POLB; Millerized OX-5, just majored. Ship completely rebuilt and recovered. New upholstering and military windshields. Full set instruments. Price, $450. Alfred Chase, Sherwood Street, Norwalk, Connecticut.

1936 RANGER FAIRCHILD 24: 65 hours. Delivered August 18th. Painted ivory and blue. Opportunity to make big saving. Max Marshall, Xenia, Ohio.

FAIRCHILD 24: 145 Warner. No time since major. Complete instrument panel. Many extras. Privately owned. $3,000. John A. Kirschke, Houston, Texas. Will sell extra motor parts for 145 Warner.

FAIRCHILD 71: Brand new year ago; worth then $13,500. Fine photographic ship. 240-gallon gasoline tanks. 2500 pounds useful load. $4,750 with skis, wheels. Alton Walker, 600 Graphic Arts Building, Kansas City, Missouri.

FAIRCHILD 24: 3-place heated cabin; 145 Warner. 279 hours. Motor recently majored by approved station. Never damaged. Plane in splendid condition, with extra equipment. $3,250. Lacy, 612 W. Cedar, Eldorado, Arkansas.

FAIRCHILD 22: American Cirrus Hi-drive motor. excellent condition. 386 hours; 22 hours since major overhaul. $1,400 and free delivery anywhere. C. C. Gilbert, Detroit City Airport, Detroit, Michigan.

1935 FAIRCHILD 24: Licensed to November, 1937. 25 hours total time on ship, 170 on motor. Motor and plane perfect. Bargain. Will trade. Cessna Aircraft Company, Wichita, Kansas.

PRIVATE, CAREFULLY maintained Warner Fairchild 22, C-7-E. Complete instrument, radio equipment, special instrument board. 420 hours total; 160 since major overhaul. For sale with or without extra equipment. Viking Flying Boat Company, New Haven, Connecticut.

FAIRCHILD KR-21: Taperwing. Fuselage recovered. 100 hp. Kinner K-5, late type front exhaust. Total time 225 hours. Ship and motor in A-1 shape. Licensed to May 1937. $925; will accept late model car in trade or will trade on Waco F-2 or F. Buddy Childress, 2414 Orange Avenue, N. W., Roanoke, Virginia.

BEST 7-PASSENGER Fairchild 71 seaplane in East. Large payload. Supercharged Wasp SC1, completely rebuilt at Pratt & Whitney factory in August; Eclipse electric starter and generator; new special type propeller; photographic apertures; landing flares, landing gear and wheels, etc. Wasp propellers, Wasp B, total time 550. AERO DIGEST, Box 2474.

DEADLINE

for

CLASSIFIED ADVERTISING

in the

JANUARY ISSUE

will be

DECEMBER 17TH

Flamingo

FOR SALE OR TRADE: Flamingo, all-metal, 8-place; licensed, night equipped. A-1 condition. AERO DIGEST, Box 2461.

Fleet

FLEET, KINNER: Prettiest Fleet in the country; Just recovered and refinished. Motor perfect; 150 hours since major. Full balloon tires, duals, compass, airspeed, clock, altimeter. Just relicensed. $1,550 cash. Florida Skyways, Miami, Florida.

FLEET: Kinner powered. Just completely recovered. The finest trainer ever built. Instruments both cockpits, airwheels. Front exhaust engine. 10 hours since top overhaul. $1,450. $700 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

FLEET: Model 7, B-5 125 hp. Kinner. Just relicensed. Airwheels, steel propeller. Real buy at $1,150. Will accept J-5 Standard in trade. Akron Airways Airport, Akron, Ohio.

Ford

J-6 FORD: Club interior; 309 gallon gas capacity, heavy cases and recent major overhaul on all engines. Full night flying equipment and many extras and spares. 2200 hours total on plane; engines have much less time. Has been used only in private service since new. Can be inspected Curtiss-Steinberg Airport, East St. Louis, Ill. Address communications to Room 609, 315 N. 12th St., St. Louis, Missouri.

Great Lakes

GREAT LAKES 2T1A: Just relicensed, excellent condition. Electric starter, brakes, steel propeller, motor just overhauled. First $900 takes it. Art Jones, Municipal Airport, Youngstown, Ohio.

GREAT LAKES 2T1A: Just relicensed to November 1937. Hand rubbed finish, blue fuselage with red wings. Airwheels. 32 hours on engine since complete major. An excellent ship. $895. Can finance one-half or will take airplane or late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

GREAT LAKES 2T1A: New engine, brakes, wheel pants, mail type windshield, metal covered to rear cockpit. Excellent condition throughout. $1,200. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

GREAT LAKES commercial plane, powered with CA Hornet; 18 hours total time on ship and motor; ship is in excellent shape and a good load carrier. Price, $4,000. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

Kellett

KELLETT K2A AUTOGIRO: Continental 210 hp. Less than 150 hours on engine; 450 hours on ship. Side-by-side seating. Completely overhauled. Privately owned. Closed cabin. Licensed. Good for advertising and dusting. Steel propeller. Hangared. $1,800 cash. AERO DIGEST, Box 2453.

Kinner

KINNER SPORTSTER: Model 100-K, Kinner K-5 motor. Only 100 hours since entire ship recovered, new control wires and cowling, motor majored, etc. Just the ship for small field operator; gets off quick, very stable, lands slow. Excellent student ship. Priced to sell at $1,400. The Vermilya-Huffman Co., Lunken Airport, Cincinnati, Ohio.

KINNER PLAYBOY: Kinner's 1936 special show job. 218 hours total time; licensed to November, 1937. Motor and plane perfect. Bargain. Consider older plane or late model used car on deal. Cessna Aircraft Company, Wichita, Kansas.

KINNER SPORTSTER: Like new. $1,750. Hugh Watson, Sharonville, Ohio.

Laird

LAIRD, WRIGHT 330: 197 hours guaranteed time since new. Beautiful high-gloss finish. Turn and bank, rate of climb, electric starter. $2,975. Can finance one-half or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Lincoln-Paige

LINCOLN PAIGE: 3POLB. Licensed until August 1937. Millerized, always hangared; new prop. Privately owned. Excellent condition. Must sell. Real bargain. Write for details. B. F. Hennacy, 3265 Colerain Avenue, Cincinnati, Ohio.

Loening

LOENING COMMUTER: Wright E motor, recently major overhauled by factory. Plane in excellent condition, well equipped; relicensed in August; price, $2,300. Beech-Air Sales Co., North Beach Airport, Jackson Heights, N. Y. Phone: NEwtown 9-0300.

Monocoupe

VELIE MONOCOUPE: Late '28 model. Licensed October 1937. Major seven hours; new Fahlin prop, new glass throughout. Sacrifice for $490 cash. Robert Freed, Pender, Nebraska.

DE LUXE LAMBERT MONOCOUPE: New January 1935. Equipment includes: radio, turn and bank, rate of climb, generator and ammeter, landing lights, cabin heater, quick release door. 275 hours; motor 75 since factory major. Ship in excellent condition. $2,400 or will consider trade on late model Stinson. George R. Farmer, 149 Elm Road, S. E., Warren, Ohio.

MONOCOUPE VELIE: 500 hours. Licensed May, 1937. Split type landing gear, airwheels, other extras. $500 cash or trade for '35 or '36 Chevrolet town sedan. Frank Preston, 1022 Mitson Boulevard, Flint, Michigan.

MONOCOUPE D-145: Warner. Cruises 140, top 160; tunnel cowl, pants, fully streamlined; complete instruments; $2,500 cash or will trade. William Miller, Hangar 3, Floyd Bennett Field, Brooklyn, New York.

MONOCOUPE VELIE: No time since major. Excellent condition throughout. A real bargain. $550. $195 down or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

LAMBERT MONOCOUPE: Excellent condition; recovered and motor just majored. Beautiful hand-rubbed finish, Insignia blue fuselage, deep orange wings; wheel pants, navigation lights, engine ring. Price $1,500. Will consider Aeronca or Cub in trade or will trade on four- or six-place cabin ship. Industrial Aviation Corp., Pyramid Life Bldg., Little Rock, Arkansas.

Monocoupe

MONOCOUPE: Lambert 90. Brand new; latest type. Black and yellow with rubbed finish throughout. Electric starter and battery, generator, landing lights, bank and turn, rate of climb, thermocouple, clock, emergency release on both doors. New ship guarantee. Boulevard Airport, Roosevelt Boulevard, Philadelphia, Pennsylvania.

MONOPREP: Velie 65 hp. motor, excellent condition, oleos, semi-airwheels, air speed, $450. Columbia Airways, Bloomsburg, Pennsylvania.

LAMBERT MONOCOUPE: Engine complete major overhaul, recovered and finished in high lustre, entire ship; special engine ring and pants; special leather upholstering; left door installed; tail wheel; price, $2,200; will consider trade; can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WARNER MONOCOUPE: Ship and motor in excellent condition. Has all instruments, blind flying hood, beam and broadcast band radio; special fairing, brakes, tail wheel, steel prop and many other extras. Total time 385 hours. Harry L. Moehlman, Elyria, Ohio.

MONOCOUPE: 1935 de luxe. Excellent condition. 80 hours since major. Bank and turn, rate of climb. Shielded. Will consider trade. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

LATE 1932 125 HP. Warner Monocoupe: Total time 490 hours; standard instruments, plus bank and turn, rate of climb, and air starter. One owner, private pilot, has taken delivery on new Luscombe. This is a real bargain at $1,550. Queen City Flying Service, Inc., Hangar 1, Lunken Airport, Cincinnati, Ohio.

LAMBERT MONOCOUPE: Good shape. Radio, oleo gear, steel propeller. $999. Stevenson-Weeks Air Service, Inc., Municipal Airport, Kansas City, Missouri.

LAMBERT MONOCOUPE: Motor factory rebuilt, heater, brakes, air wheels, never damaged, privately owned. Relicensed May. 355 hours. $1,350. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

Moth

WRIGHT GIPSY MOTH: Perfect! Airwheels, interphone, slots, folding wings. Beautiful job! Identified. Take LeBlond, J-5 or crack-up in trade. Kidd, Box 195, San Antonio, Texas.

MOTH GIPSY: Just recovered. 100 hours since engine major. $745. $200 down or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

N-B Trainer

NB-8, GENET 80: Total honest time 271 hours; used extensively for private purposes; never cracked; 67 hours on ship since complete overhauling, including grade "A" Flightex; rubbed vermilion red fuselage; yellow wings; black engine ring: cowling and trimmings; new factory design cabin enclosure; engine recently majored; extra instruments; licensed until July 15, 1937. Perfect condition. This is ideal for student work, flying clubs, or private use. $675 cash. H. W. Banbury, 103 Williams Street, Royal Oak, Michigan.

BARLING NB-3: Low wing, Genet powered, three-place. Engine just majored, airplane completely recovered, reupholstered. Will accept 1936 automobile in trade or can finance one-half. $795. St. Louis Flying Service, Incorporated, Lambert Field, St. Louis, Missouri.

New Standard

J-5 NEW STANDARD: 5-place, very clean, Standard steel propeller, all lights, flares, tail wheel, starter; motor completely reconditioned. $1,650; trades considered. Supt. Kipp, Randolph, Minnesota.

STANDARD J-5: Five-place. Fuselage just recovered, engine just majored, wings refinished. High-polish finish. Guaranteed best Standard in the country. $1,950. $1,200 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

J-5 STANDARD: Model D-25. Finished red and cream. Starter, lights. Just relicensed. Must sell for best offer. Can finance. Al Leeward, New Kensington, Pennsylvania.

Parks

PARKS OX-5: 3-place biplane. Painted Berryloid red. Completely factory overhauled. New Hamilton adjustable pitch steel propeller. Full description in letter. Price, $550. Robert Quigley, Box 87, Highland, Indiana.

Pitcairn

PA-7 MAILWING: 760 hours total on ship, (30 since recovering), licensed till October '37. 496 hours total on J6-7E engine (30 since top overhaul—155 since major). Semi-airwheels, landing and navigation lights, NACA cowl, starter, banner release. $1,600 complete, or will sell separately: $800 for ship and same for engine, prop and starter. Basil Aviation Co., Somerton Airport, Philadelphia, Pa.

Pitcairn Autogiro

PITCAIRN AUTOGIRO PAA-1: Like new. K-5 Kinner 125 hp. Must be seen to be appreciated. $1,850 or trade for four-place cabin ship. Consolidated Aircraft Repair, Inc., Fort Wayne, Indiana.

Porterfield

1936 PORTERFIELD: LeBlond 70 demonstrator, dual controls, dual brakes, speed ring, etc.; very little time; reasonably priced. Bush, 5214 W. 63rd St., Chicago, Illinois.

Ryan

FINEST, FASTEST J-5 Ryan in U.S.A. Completely rebuilt, highest grade materials used. Silver wings, vermilion fuselage, black trim. Engine just topped. Speed ring, landing gear and wing fittings streamlined. Cruises 115. Will accept Velie Coupe, Cavalier, Taylor Cub or Aeronca in trade if in perfect condition. Price $1,600. Walter D. Mauk, Blackwell, Oklahoma.

RYAN ST: 125 hp. Menasco. Less than 200 hours. $3,100. Also absolutely new Ryan ST's. Never flown; at substantial discount. Hugh Watson, Sharonville, Ohio.

Rearwin

REARWIN SPORTSTER: 1936 model 7000. Brakes, speed ring, air speed, navigation lights, carburetor heater. Never cracked; excellent condition. Will sacrifice. Earl Kail, McKinley Airport, Canton, Ohio.

Spartan

SPARTAN LOW WING: Side by side, relicensed. Red wings, black fuselage. Powered with Jacobs 55 hp. Just majored, $900. Foster A. Lane, Port Columbus, Columbus, Ohio.

Star

STAR CAVALIER: Lambert engine. Ship recovered, engine overhauled. Wonderful buy at $850. Stevenson-Weeks Air Service, Inc., Municipal Airport, Kansas City, Missouri.

Stearman

PRIVATELY OWNED Stearman C-3-R: J6-7 Wright 240 hp. Radio, complete instruments both cockpits, tail wheel. 150 hours since major overhaul. 60 since recovering. Never a mishap. All ready for extended trip. Viking Flying Boat Company, New Haven, Connecticut.

J6-7 STEARMAN: Model C3R, completely recovered, motor majored, air wheels, parking brake, steerable tail wheel, full set instruments front and rear, blind flying hood, radio, electric starter, ship like new. Must sacrifice. Lewis Air Service, Union Air Terminal, Burbank, California.

Stinson

STINSON JR. SM8A: Perfect condition. Just majored. Sacrifice for quick sale. $1,200 cash. Chandler Flying Service, Crosby, North Dakota.

1934 STINSON RELIANT: 273 hours; 71 hours since majored on motor; licensed until October 1, 1938. Color high-gloss solid maroon finish. Equipment: 75-gallon gas tanks, pants, fenders, R C A receiver and R C A transmitter, sensitive altimeter, directional gyro, manifold pressure gauge, head temperature gauge, Smith controllable propeller, flares, landing lights. Ship bonded and shielded throughout. Not a scratch on ship anywhere. Never cracked. Always privately owned. Price, $4,750. H. W. Bresee, 650 S. Salina St., Syracuse, New York.

1935 SR-6B, DE LUXE throughout. Cost nearly $9,000. Full of instruments and RCA radio. Smith controllable. Large tanks. Genuine leather upholstery. Everything positively the finest. Only few hours total. Special paint. Maintained by expert with no regard for cost. It would be impossible to buy a more beautiful or finer Stinson. $5,895. Karl Voelter, All American Airport, Miami, Florida.

MODEL SM8A STINSON: Bargain. Lots of service in this ship. Will trade. Cessna Aircraft Company, Wichita, Kansas.

RELIANT: Beautiful and perfect throughout. Constantly maintained by major airline. New tires, night and blind flying equipment and radio. Just completely checked by airline mechanics. A marvelous buy at $2,600. Eastern Aeronautical Corporation, Airport, Newark, New Jersey.

FOR SALE IMMEDIATELY: One J6-7 Stinson, good condition, $1,200. One J6-9 Stinson, $1,500. Both have had approximately 100 hours since overhaul and are in good flying condition. One J6-7 motor, overhauled and in first class condition, $750. Wallace Aerial Surveys, Spokane, Washington.

STINSON RELIANT: Delivered August, 1933. Special paint, upholstery. Standard instruments plus radio, landing lights, flares, turn and bank, rate of climb, directional gyro, and eight-day stop-watch clock. About 470 total hours; 125 since top overhaul. Ship and engine always received finest care. Perfect in every respect. Looks and flies like new. Never damaged. Asking $3,000. Make bids. D. Manning, Room 1400, 25 Broad Street, New York. Hanover 2-8050.

STINSON SR.: Lycoming. Licensed July, 1936. Turn and bank, rate of climb, landing lights, leather upholstery, $2,850, cash or will trade. William Miller, Hangar 3, Floyd Bennett Field, Brooklyn, N. Y.

STINSON SM8A: Lycoming, night equipment; radio, turn and bank, rate of climb, excellent condition. Blue fuselage, vermilion trimmed. $1,375. Glenn Barr, City Airport, Detroit, Michigan.

STINSON SM8A: Recently recovered, high-luster finish. An excellent and attractive four-place job. $1,595. Can finance or take trade and will consider late model car. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON MODEL W: Wasp Jr., just topped; ship and motor in excellent condition throughout. Electric inertia starter, bank and turn, rate of climb, clock, thermocouple; both gravity and fuel pressure systems; fender. Price, $2,250. White Flying Service, Caldwell Airport, Caldwell, New Jersey. Caldwell 6-1560.

STINSON JR.: (SM7B). Wasp Jr. (300) powered. 610 hours total, including ground time; 160 since overhaul. Ship and engine in A-1 shape. Licensed till June, '37. Starter, generator, navigation and landing lights, flares, bank and turn, rate of climb, air temperature, beam and entertainment radio, ring, pants, etc. Complete details and photograph on request. Basil Aviation Co., Somerton Airport, Philadelphia, Pennsylvania.

STINSON RELIANT SR-6B: Lycoming 245 hp.; Smith controllable propeller; vacuum flaps; landing lights, flares, radio; all instruments. Maroon and cream with red leather upholstery. Ship has 300 hours, motor 10 since new. Excellent condition. Selling to obtain latest demonstrator. Boulevard Airport, Roosevelt Blvd., Philadelphia, Pa.

STINSON RELIANT: 1933; blue and yellow; large gas tanks; turn and bank, rate of climb; leather upholstery; $2,950. Will finance. Brayton Flying Service, Robertson, Missouri.

1935 SR-6: Privately owned Stinson Reliant, NC-15122, $5,885. Cost nearly $9,000 with extras, including standard instruments plus Kollsman sensitive altimeter; Smith controllable propeller; 100 gallon tanks, flares, landing lights, RCA radio, turn and bank, red and cream finish with matching red leather upholstery; purchased new from Stinson September, 1935; never cracked; flown by one pilot only; maintained without regard for cost, used for personal travel only. M. Reynolds, 542 S. Dearborn Street, Chicago, Illinois.

STINSON S: Lycoming. Privately owned. Turn and bank, rate of climb, electric starter, speed ring, wheel fenders; perfect condition. Used for business trips only. Always hangared, never cracked. $1,600 cash; no trade. Paul C. Temple, St. Nicholas Hotel, Decatur, Illinois.

STINSON SM8A: Modernized motor. Excellent condition. Landing lights, flares; just repainted. A real bargain at $1,475. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

WARNER STINSON: Recovered year ago. The most economical passenger carrying ship ever built. $750. Can finance one-half or will take late model car in trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Taylorcraft

TAYLORCRAFT 1936: 5 months old, excellent condition throughout; $945. White Flying Service, Caldwell Airport, Caldwell, New Jersey. Telephone: Caldwell 6-1560.

Travel Air

MODEL 2000 TRAVEL AIR biplane: New OX-5 Millerized; licensed to November 15, 1937. Black fuselage, gold stripe and wings. Excellent condition. $600 flyaway. Leo Jackson, Mt. Hawley Airport, Peoria, Illinois.

Travel Air

TRAVEL AIR OX: Millerized, in grand shape. Will deliver West or South free. East for expenses. Reasonable at $350. Clyde Williams, Moorcroft, Wyoming.

TRAVEL AIR 6000-B: J6-9; recovered and relicensed, blind flight instruments, booster, starter, new cabin interior; never cracked; vermilion and black. Engine total logged time, 100 hours; modernized and latest improvements. Must sell to settle estate. $1,500. Iowa Airways, Fort Dodge, Iowa.

CHALLENGER TRAVEL AIR: Bargain. Ship and motor best of condition. Licensed to November, 1937. Will take in car on deal. Cessna Aircraft Company, Wichita, Kansas.

TRAVEL AIR 6000-B: 330 hp. modernized Wright. Perfect condition. Color vermilion with cream wings. Flares, landing lights. $2,250. Hugh Watson, Sharonville, Ohio.

TRAVEL AIR J6-5: Licensed to July 1937. Semi-airwheels, steel propeller, bank and turn, rate of climb, brakes. Engine perfect condition, with 125 hours since major. $1,195. Can finance one-half and will take trade. St. Louis Flying Service, Inc., Lambert Field, St Louis, Missouri.

CURTISS-WRIGHT Travel Air 16-K: Kinner 125 hp. Three-place, high lustre finish, orange and black; just relicensed, Bargain $1,375. Foster A. Lane, Port Columbus, Ohio.

Verville

J6-7 VERVILLE CABIN: Original finish, perfect, clean. Engine just majored. Retractable lights. Outperforms Stinsons. Goes 18,000 feet. Economical. $1,295. Merle Buck, Stratford Apartments, Madison, Wisconsin.

Viking

VIKING BOAT: Four-place, excellent condition; starter, lights, metal prop, fabric perfect, compass, anchor, all extras. Just relicensed. Good performance. AERO DIGEST, Box 2462.

Waco

WACO TAPERWING, J6-9D: Late type landing gear, air wheels, completely equipped for sky-writing. Licensed until April 1937. 97 gal. gas tanks. $1,350. Kenneth V. Nisun, 2436 11th Avenue South, Minneapolis, Minnesota.

WACO '34: De luxe cabin, Jacobs powered; special paint, pants, air brakes, splendid condition. $3,500 cash. Will demonstrate anywhere in U. S. J. Turner Moore, Jr., Box 893, Reading, Pennsylvania.

1936 CUSTOM WACO: Jacobs 225. Curtiss prop, generator, pants, large gas tanks, flares, lights, bonded, shielded, RCA receiver. Licensed as 5-place with full tanks. Turn and bank, rate of climb, clock. Four months old; less than 100 hours; will carry new ship guarantee. Cost over $8,000. Will sacrifice for quick sale. Ship has not a scratch and cannot be told from new. Dixie Airways, Inc., Shushan Airport, New Orleans, Louisiana.

WARNER WACO F: Newly majored and covered. In perfect shape. $1,450. Witch Duck Aeroplane Corporation, 248 Bank Street, Norfolk, Virginia.

WACO 10 GXE: Licensed June '37. Extras: Hamilton steel prop, Millerized, Scintilla magneto, compass, air speed, duals; covering excellent. $500. G. Vincent Hazelton, Sewell, New Jersey.

WACO, CONTINENTAL 165 hp.: Airwheels, brakes, starter, tail wheel, duals, Pioneer instruments, A-1 shape, speed ring. $600 cash. Leonard Lein, 2900 W. Lapham St., Milwaukee, Wisc.

WACO STRAIGHTWING: J6-5, licensed. Motor, ship excellent condition. Tail wheel, starter, brakes, instruments. Priced to sell. Norman J. Schaffer, Ontonagon, Michigan.

WACO C: 165; just recovered, new upholstery, motor majored, total time 350 hours. A clean ship for any purpose; cash or part trade. Midwestern Aviation Corporation, Seymour, Indiana.

WACO A: Late '32 170 hp. Jacobs; 180 hours on motor since new. Yellow and black; radio, starter, turn and bank, navigation and landing lights, winter enclosure. $1,475, Pittsburgh. Walter C. Hartman, County Airport, Pittsburgh, Pennsylvania.

WACO 1935 CUSTOM CABIN: Jacobs 225. 306 hours; 1936 engine, 120 hours. Beautiful finish, 95 gas, pants, red leather upholstery, bank and turn, rate of climb, Kollsman, radio, landing lights, flares, starter, generator, vacuum flaps. Excellent condition. $4,950. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO NINE: OX-5, just major overhauled. Plane very clean and in excellent condition. One of the best performing OX-5 jobs in the country. Price $360. Will deliver for expenses. Elwyn West, Route 3, Appleton, Wisconsin.

'35 WACO CABIN: Jacobs powered. 155 hours total time. Has landing lights, flares, RCA radio, large gas tanks, wheel pants, bank and turn, leather upholstery, licensed for five. Cruises 135; a beautiful ship at a real buy. T. M. Stoner, 328 Gale Street, Aurora, Illinois.

WACO F: Kinner B-5. New type heads. Covering excellent, ship in good condition throughout. A buy at $1,475. Will finance. Hamilton Aviation Corporation, Hamilton Airport, Hamilton, Ohio.

1935 WACO CUSTOM: 5-place. 225 Jacobs, electric starter and generator; 230 hours total time; licensed September '37; lots of extras; priced to sell. Tex LaGrone, Municipal Airport, Kansas City, Mo.

WACO J-5: High-gloss hand-rubbed finish. Yellow trimmed with brown. 18 coats dope. Guaranteed finest J-5 Waco in United States. We really mean it. $1,275. Can finance one-half or will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

DE LUXE WACO CABIN: 1934. No time since complete major on 250 Wright engine. Ship completely rebuilt; beautiful new hand rubbed finish. Priced to sell. Air Activities, Inc., Municipal Airport, Houston, Texas.

WACO STRAIGHTWING J6-5: Modernized; fuselage and tail recovered; just licensed. An excellent performer, in excellent condition. $1,100. Boulevard Airport, Roosevelt Blvd., Philadelphia, Penna.

WACO A: Late 1933 Jacobs; 20:00 since major; radio, bank and turn, Heywood starter; wheel pants, speed ring; yellow fuselage, green wings; excellent condition; price $2,000. Will consider trade, can finance 40%. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

The January issue
will be
AERO DIGEST's 2nd Annual
"Digest of Aircraft
& Engine Machinery"

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FORMS CLOSE DECEMBER 17TH

FOR SALE: 1933 model Waco cabin, equipped with metal propeller, radio receiver, flares, blind flying equipment, genuine leather upholstery, special color and in very fine condition. A real bargain for cash. Troy Flying Service, Troy, Ohio.

LATE 1933 WACO CABIN: 210 hp. Continental motor now being overhauled. Total time 490 hours. Painted Waco red. Wheel pants, bank and turn, rate of climb, landing lights and flares, air starter. Price, $2,950. Queen City Flying Service, Inc., Hangar 1, Lunken Airport Cincinnati, Ohio.

WACO F-2: 165 Continental. Landing lights, flares, front cockpit cover, Hamilton prop just etched, Eclipse starter, pants, speed ring and duals. Priced to sell. Waco F, 125 Warner; little time since major; total motor time 576 hours; steel prop, Heywood starter, duals; ship in good shape. Bush, 5214 W. 63rd St., Chicago, Illinois.

WACO F KINNER B-5: Five new heads, Heywood starter, black with red wings. Relicensed August. 450 hours. $1,450. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

1932 WACO CABIN: Many extras, steel prop. Settlement of an estate, must be sold. Air Activities, Inc., Municipal Airport, Houston, Texas.

WACO OX: Cleanest OX job we have ever owned. Licensed to July 1937. Hand rubbed finish. $475. $275 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

1933 DE LUXE Cabin Waco: Continental 225. Hamilton steel prop, large gas tanks, flares, wired for lights, bonded, shielded, Westport receiver, turn bank, climb indicator, clock, leather upholstery, full fairing, air brakes. Less than 200 hours since major. Ship in perfect condition. Licensed till August, 1937. All tires new, all pyralin new. Ship thoroughly inspected and reconditioned by factory where necessary. Priced for quick sale. Dixie Airways, Inc., Shushan Airport, New Orleans, Louisiana.

WACO 1934 CABIN: Jacobs 225. 418 hours total, no time engine since major overhaul and modernized; special finish, vermilion; pants, air brakes, starter, generator, landing lights, flares, 70 gas. Excellent condition. $3,200. Central Aeronautical Corp., Municipal Airport, Indianapolis, Indiana.

Miscellaneous Aircraft

TAYLOR CUB: J-2 model, A-40-3 engine; new May 1936, 145 hours, licensed; copper finish; bargain at $1,150. Write for details and photo. Also licensed Bull Pup, just majored, $450. Valley Airways, Inc., Winchester, Virginia.

STINSON, WASP JR.. Complete equipment and perfect throughout, $2,250. Stinson SM8A, condition good, $1,150. OX-5 Travel Air, just refinished and relicensed, air wheels $500. George Haven, Airport, Schenectady, New York.

ARROW SPORT: Kinner K-5; licensed until October, 1937. $700. J-4 Straightwing Waco, licensed until July, 1937. $1,000. Hiltner and Carpenter Flying Service, Continental, Ohio.

HUNDREDS OF AIRPLANES, motors, crack-ups, parachutes; OX-5 jobs $75 up. Terms. Complete directory with owner's price, name and address, 25c postpaid. Aircraft Directory, Athens, Ohio.

STINSON RELIANT: '33 De Luxe, radio, night flying equipment. Low wing Aeronca, 85 LeBlond, high compression pistons, like new. Bob Duckworth, Bowman Field, Louisville, Kentucky.

$150 TO $500 IS ALL you need to secure open cabin airplane. Pay balance while you fly. Taylor Cub, $350 down; Pitcairn, $475 down; Waco, $250 down; Monosport, $450 down; Taperwing, $500 down; Robin, 300 down; Waco cabin, $1,000 down; Travel Air, $250 down; Velie Monocoupe, $300 down; Ryan, $450 down; Lycoming Stinson, $550 down; J6-5 Travel Air, $475 down; Waco F, $600 down. Pioneer Aircraft, Airport, Syracuse, New York.

LATE TAYLOR CUB: Like new, $950. Stinson 8A, Lycoming; donut tires; $1,550. Consider car, diamond or wrecked Lambert Monocoupe as part payment. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

LATEST MODEL Taylor Cub, $950. Avro-Avian, $550. Kinner Bird, $950. Challenger Robin, $1,050. OX-5 Command-Aire, $275. Wasp B, $275. AERO DIGEST, Box 2465.

FOR SALE: Waco J-5, latest model; starter, speed ring, semi-airwheels, extra instruments; $1,400. Travel Air OX-5, brand new motor; just relicensed, $600. Rearwin Sportster, demonstrator; brakes, speed ring, heater; $1,950. Waco OX-5, built 1931; A-1 condition; spare motor; $575. Ringel Flying Service, 917 Bigelow, Peoria, Illinois.

WACO F, WARNER: Has air speed and bank and turn; Stinson S, perfect condition; Stinson SM2AB, 4-place, J-5 engine, overhauled and recovered; Rover Driggs; 1935 Aeronca; J6-5 Aristocrat; miscellaneous equipment. Air Activities Airport, West Chicago, Illinois.

REPOSSESSED Porterfields, Cubs, Ryan B-1, Wallace, Star Cavalier, Aeroncas, Waco 10, Challenger and Eaglerock OX-5's, Travel Air biplane (150 hp.), Aeromarine Klemm and Stinson SR-5 airplanes. J6-7, Kinner, Continental A-40-2, Cirrus Mark III motors. Airplane parts for Moths, Avians, Stinson, Sikorsky S-38 and American Eagles. Small down payment and balance monthly on anything we have. Write Aviation Finance Co., Hemlock, New York.

TAYLOR CUB: A-40, good shape, $650. Rearwin Jr., Aeromarine motor, a buy at $650. Warner Waco F, 3 hours since ship and engine majored, $1,600. Penn-Harris Airport, Harrisburg, Pennsylvania.

125 WARNER CESSNA: Licensed to September, 1937. Eight hours since motor overhaul; pants, full NACA cowling, semi-airwheels, brakes, tail wheel. Fabric excellent, high gloss finish. Want recent Monocoupe or Stinson. For sale: Driggs Skylark, Rover powered; total time 480 hours; licensed to August, 1937; motor just majored. $600 for quick sale. Palwaukee Airport, Inc., Mt. Prospect, Illinois.

SKIS! SKIS! SKIS! We have for sale several pairs of different makes and models of aircraft skis, both new and used. Sizes for all makes of aircraft, from 1,000 lb. up to trimotors; priced very attractively. Michigan Aero Motors, Jackson, Michigan.

WACO GXE: Licensed, $400; Millerized. Arrow Sport 65, licensed, $700; recovered. Coffman, 802 Thurman, Saginaw, Michigan.

WACO CABIN SEAPLANE: Night flying equipment. Less than 50 hours on motor since major. Will sell on wheels or floats. Cessna J6-7; Avro-Avian; American Moth; Stinson; '35 Taylor Cub; others. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

FLEET: Front exhaust Kinner; priced for quick sale. Waco C, 165 Continental, for sale or trade. Fairchild KR-31, OXX-6, priced right. York Flying Service, Inc., Box 118, York, Pennsylvania.

ENGINES

VELIE M-5: Major overhauled, excellent condition, complete with hub. A real buy at $125, crated. Want LeBlond 5-D motor. Kidd, Box 195, San Antonio, Texas.

LE BLOND 90: Model 7-D. Seven cylinder, radial, air-cooled engine. Completely majored and ready to install. Price $225. E. W. Renfroe, 4646 Michigan Avenue, Chicago, Illinois.

J6-5, SALE OR TRADE: 375 hours. 20 since top. Hamilton Steel propeller, Heywood starter. Trade for Warner 125. Anthony Riccio, 268 Maryland Street, Buffalo, New York.

VELIE M-5 MOTOR: $100; also Velie parts. Want Monocoupe skis and parts, also front half Velie crankshaft. Manvil Larson, 124 Belmont Road, Grand Forks, North Dakota.

KINNER R-5 engine, complete; approximately 40 hours. Bargain. Also Wright Gipsy parts at low prices. Air Activities, Inc., Municipal Airport, Houston, Texas.

ENGINES: J6-7, modernized, $495. Velie, $95. Warner parts; cylinder, $15. J6-7 prop hub, $25. Airwheels, brakes, 29 x 13 x 5, and Stinson air tail wheel, $90. Merle Buck, Stratford Apartments, Madison, Wisconsin.

FOR SALE: One Continental 210 hp. engine. Total time 140 hours; just major overhauled and modernized by Continental factory, including installation of forged pistons and sodium cooled exhaust valves. Price, $1,100. Troy Flying Service, Troy, Ohio.

LYCOMING R-680-BA: 240 hp., completely overhauled and equipped with starter, generator, magneto and propeller, $1,150. Cyclone R1750AB, never off ground, equipped with electric inertia starter, generator, carburetor and magnetos; $1,000. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

ENGLISH CIRRUS Mark III: 95 horsepower upright, brand new; original crate; last of lot purchased customs auction. $275. N. W. Perdew, Hasbrouck Heights, New Jersey.

LAWRANCE 2-THROW, D.H. Gipsy; experimental 2-cylinder with dual ignition. Cotton sport plane with Lawrance 2-throw motor, damaged but repairable. $60. B. Elwood, 1758 W. Forest, Detroit, Michigan.

WANTED TO BUY OR TRADE

WANTED: Gas tank for 129 Kinner American Eagle. Must be A-1 condition. Bob Allen, Walters, Oklahoma.

WANTED: Wright Moorehouse, Bristol Cherub, Lawrance 28, any condition; must be complete. Condition and price in first letter. E. Stewart, 5860 Lake Street, Chicago, Illinois.

WANTED: Warner Scarab or Super Scarab engine in approved airworthy condition. Fully equipped. Preferably with maker's guarantee. Particulars and price to AERO DIGEST, Box 2454.

MINNESOTA unimproved farm land to trade for any licensed airplane. Will pay cash for steel in Reliant. Dick Schall, 4236 Queen Ave. So., Minneapolis, Minnesota.

WANTED: Left lower wing for Model A Bird; will consider cracked Bird, any model, or what have you? Arner & Getz, Lehighton Airport, Lehighton, Pennsylvania.

WANTED: Will pay cash for aerial lens and K-5 aerial camera. Burke & James, Inc., 223-225 W. Madison Street, Chicago, Illinois.

CASH FOR recently majored Lycoming Stinson in good condition. Must be bargain. Give full particulars, lowest cash price in first letter. Box 143, Rockville, Maryland.

GMC MOTOR COACH and Brockway School Bus. Want 2- or 3-place ship. Will pay some cash difference on new job. Write George Thoreson, Turtle Creek, Pennsylvania.

WANTED: J-5 Travel Air. Will consider rebuilding. No crack-ups wanted. State true condition, special features and lowest cash price. E. W. Renfroe, 4646 Michigan Avenue, Chicago, Illinois.

USE PIONEER SERVICE when buying, selling or having airplane sales financed. Largest selection of used airplanes and parts in America. Pioneer Aviation, Airport, Syracuse, New York.

WANTED: Aircraft engines and parts. Highest cash prices. Air-Parts, Inc., Glendale, California.

WANTED: 1929 Lambert 90 Monocoupe fuselage. State condition and lowest cash price. Also Velie M-5 motor. Ralph Coston, Luscombe Airplane Development Corporation, West Trenton, New Jersey.

WANTED: Challenger Travel Air, licenseable, complete less motor. Warner Waco F, late Rearwin Sportster or Cub, if bargains. Engines: Szekely, Aeromarine 50, Velie M-5, LeBlond; guaranteed and bargains. Pair 18 x 8 x 3 casings, tubes, hubs with brakes; 16 x 7 x 3 casings. Grimes retractable lights; flares. For sale: Challenger engine, 505 hours, late cam; needs major and few parts. $200, crated. Ray Baumgardner, Big Spring, Texas.

WANTED FOR CASH: 3-4 place airplane. Give details, and price. 122 South Sixth Street, Brawley, California.

WANTED TO BUY crack-ups for cash. Write details and price first letter. Also interested in ship needing recovering. Jesse Jones, Lancaster, Pa.

WANTED TO BUY for cash: Warner F or Arrow Sport, LeBlond 90 or Taylor Cub. State lowest cash price, first letter. No crack-ups need answer. Must be in first class condition and licensed. Box 1403, Miami, Arizona.

WANTED FOR CASH: Aeronca or Cub and 3-place open ship. Also cabin job, Monocoupe, Stinson, etc. Need ships immediately. Must be bargain. John Rieger, Brackenridge, Pa.

AIRPLANE WANTED: Will trade 1½-ton dual wheel van type Ford truck and cash. Good rubber. Exchange that ship eating self with storage into earning power. Aviation Finance Co., Hemlock, New York.

WANTED: Highest cash prices paid for cracked airplanes, motors and parts; any make, any condition. Give complete details. Industrial Aviation Corp., Pyramid Life Building, Little Rock, Arkansas.

WANTED: Magnetos for 7-cylinder 113 hp. Siemens-Halske motor. Columbia Airways, Bloomsburg, Pennsylvania.

WANTED: Pair Edo floats for 1936 Lambert Monocoupe. State price, age, condition and serial number. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WILL PAY CASH Jacobs Waco about 1934. Prefer night flying equipment. Rush details and photograph. Will buy before January first. Dewey Tatro Company, Decorah, Iowa.

WANTED FOR CASH: Light ship, under 75 hp. Must be priced to sell. Write at once. Aeronca preferred. Donnelly, 3205—81st Street, Jackson Heights, New York.

WANTED: Manufacturing rights on low cost approved airplane, one in process of approval, or one eligible for approval. Complete information first letter. AERO DIGEST, Box 2467.

WANTED: Travel Air 3-place job, with bolted Hisso motor mount, cowling. Late type landing gear with or without covering or motor. Cash. Edward Minter, 1415 Tenth St., N. W., Roanoke, Virginia.

CASH FOR crack-ups or ships in need of repair or will trade Bird Waco J6-7, Aeronca; all in A-1 shape. Box 1414, Knoxville, Tennessee.

WILL TRADE good farm land, 700 acres in wheat, in Colorado, Texas or Nebraska for small training ship, Aeronca or others similar. Also trade for 3- or 6-place ship; prefer Fairchild, Stinson or Waco. Some cash if justified. Dr. Beiderwell, Belleville, Kansas.

WANTED: B-5 125 horsepower motor in good condition. AERO DIGEST, Box 2469.

WARNER 125 or Kinner 100 hp. engine wanted; give full information first letter. Have Curtiss Junior parts. Seymour Aviation Club, Inc., Seymour, Ind.

WANTED: One Genet motor, 85 hp., or parts. State condition and price first letter. J. J. Kirby, Smith's Grove, Kentucky.

WANTED: 1933 to 1935 Aeronca C-3, with enclosure and skis. Also skis to fit Eaglerock. Will trade $250 perfect diamond ring and cash. Wire or write AERO DIGEST, Box 2473.

WANTED: J-5 motor for cash. State model, serial, total hours, hours since overhaul, cylinders standard or oversize, price in first letter. Lombard Airport Co., Lombard, Illinois.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

NEW HARTZELL wood propellers for sale. For Wright J-4-5-6 engine, $30 each. For Hisso A and E engines, $27.50 each. For LeBlond, $20. For 160 Kinner, $30. For Continental 210, high cruising speed propeller, $60 each. Troy Flying Service, Troy, Ohio.

14 x 3 N.S. TIRES, tubes and wheels, $8. 500 x 3 tires, tubes and wheels, $9. 700 x 4 tires and tubes, $13; wheels, $4. 24 x 4 or 26 x 5 tires, tubes and wheels, $8 each; all brand new. Practically new Velie 90 hp., complete, $2[illegible]0. New Szekely late model motors, $250. 70 hp. Siemens-Halske motors, brand new, $250. Pioneer straightway compass, type 301 and one Pioneer earth inductor compass generator; make offer. Crawford Airplane Supply Company, Venice, California.

FOR SALE: 1 J6-7 complete, needing overhaul. 1 Heywood air starter for same, complete, in A-1 condition. 2 Fleet model 2 stabilizers. Stearman C3B tail assembly. Turn and banks, rate of climbs, air speeds, altimeters and engine instruments. Wanted: 1 used generator for Lycoming, wind or motor type. 1 directional gyro. 1 Kollsman sensitive type altimeter. 1 ammeter. 1 beam receiver. 1 transmitter. 18 Breeze plug shields. J. D. Greer, care U. S. Weather Bureau, Murfreesboro, Tennessee.

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ENGINE PARTS: J-5, Kinner, Cirrus. Propellers: Standard steel, reconditioned, J-5 and Warner, $90 each. American Avian parts, complete. New engine covers, all sizes, $6. Bolts, nuts, instruments. Dick Schall, Chandler Building, Suite 1110, Washington, D. C.

HAMILTON ADJUSTABLE propeller for Hi-drive Cirrus motor, approved type, also one pair Scintilla magneto with impulse for same. C. Descomb, Crystal Drive, Wethersfield, Conn.

ATTENTION, CUB OWNERS: Ideal carburetor and cabin heater combined with bayonet stack for Continental motors. Improves performance. Real necessity. Also pneumatic tire tail wheel assembly, steerable with rudder. Replaces spring assembly. Consolidated Aircraft Repair, Inc., Fort Wayne, Indiana.

FOR SALE: J6-5 Hamilton Standard propeller; Pioneer turn and bank; Pioneer altimeter; Pioneer compass; Eclipse 3HB6 starter with booster for J-6 or similar. Also other Eclipse inertia starters. Pair Moth axles, Robin axles, Travel Air 2000 axles. DH Gipsy crankshaft; 8:50 x 10 tire; J6-5 and -9 exhaust collector ring. Also J6-9, Challenger and Kinner engine parts. Plenty of Fledgling and some Robin struts and parts. Write for prices or make offer. Baltimore Flying Service, Inc., Baltimore, Md.

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TANKS, COOLERS, collector rings, struts, engine mounts, fittings, cowlings, windshields, pants. Special or replacement parts of every kind to order. Complete repair service. Most reasonable prices East. LeBlond engines. December special: B-5 collectors, $36.50. Aircraft Development Company, Washington, D. C.

FOR SALE: J-5 cases, carburetor, magnetos, etc., or will trade for J-5 two-piece exhaust manifold, or J-5 air starter. Box 1414, Knoxville, Tennessee.

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FOR SALE: Challenger KR-31, good condition, licensed until April, 1937; $400. Hamilton Standard propeller, licensed for Warner 125 hp., Kinner 100 hp.; not used since overhauled at Ford's; $65. Major overhauled OX-5 motor, $50. Fireproof hangar storage, $8 per month for light ships; $10 per month for Stinsons and Wacos. We will call for and deliver ships for expenses. R. E. Lee, Municipal Airport, Rocky Mount, North Carolina.

FOR SALE: Hamilton Standard controllable pitch propeller, suitable for use on Wright 285 or 320 hp. engines. Total time on propeller, 150 hours. Never bent or damaged in any way. Troy Flying Service, Troy, Ohio.

STINSON TRIMOTOR T and U parts; Pilgrim parts, Hamilton Standard adjustable propellers; Great Lakes Trainer wood propellers, new, $20 each; Wiley reconditioned flares, $20 each; cylinders, magnetos, carburetors; tail wheels and tires; gas and oil tanks; J-6 parts; miscellaneous parts. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

XMAS TIP: 92 aircraft picture collection. All types. Send one dollar to Blondin Chart Co., Box 34, Los Angeles, California.

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FLEET PARTS: New lower wings complete, $150 each. Other Fleet parts at 60% off factory list prices. Stevenson-Weeks Air Service, Inc., Municipal Airport, Kansas City, Missouri.

PARTS FOR: Kinner; Szekely; Wright J5-5,-7,-9; Cyclone F-50; Cirrus; Gipsy; Hisso; Wasp and Hornet engines. Chuck O'Connor, Municipal Airport, Westfield, Massachusetts.

BARGAIN IN NEW EQUIPMENT: I have the following brand new equipment which has never been used or installed: Thermocouple, Pioneer tachometer, oil temperature thermometer, oil pressure gauge, Grimes electric retractable landing lights, set of three 1½ minute flares with switch box, Western Electric radio receiver with beacon and broadcast bands. Will sell at retail prices less 40%. AERO DIGEST, Box 2477.

CHALLENGER ROBIN PARTS: Uncovered fuselage, controls, ailerons, rudders, fins, stabilizers, right wing complete with tank. Wasp B, Velie and Challenger motors. Mid-City Flying Service, Hudson, Ohio.

J-5 LATE CAM GEARS: New, pairs, $29.50. Large stock Cyclone, Kinner, Comet, Hornet, Menasco, OX-5, Axelson parts. Dycer Airport, 94th and Western, Los Angeles, California.

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TRANSPORT PILOT: 28, college; 2600 hours—900 XC, 300 night; 5 years test pilot Taylor Aircraft Co. Experienced salesman, thorough, well-seasoned, progressive. Wants opportunity. R. C. Havens, Akron, New York.

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AERONAUTICAL and Mechanical Designing Engineer: College graduate, 8 years' practical experience with two leading airplane manufacturers and U. S. Navy. Desires responsible position with airplane manufacturing concern or with consulting engineer. W. A. Semion, 323 S. 45th Street, Philadelphia, Pennsylvania.

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PARACHUTES: Irving and Switlik chutes, new and used. Wanted at all times used parachutes for cash. Describe fully. Air thrillers for airports, celebrations, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

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GOOD EXPERIENCED INSTRUCTOR wanted for Wisconsin area. Must handle charter and assist in sales work. Give full details, references and salary or commission expected. AERO DIGEST, Box 2470.

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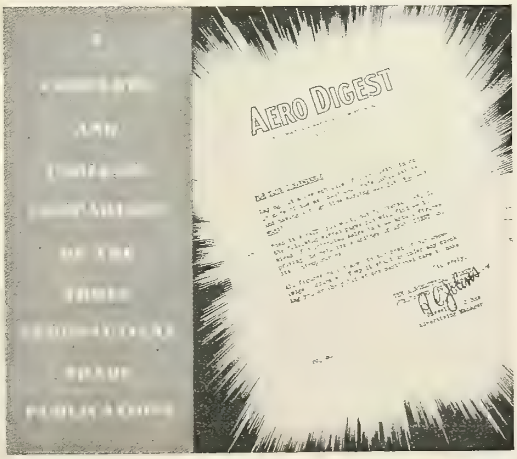

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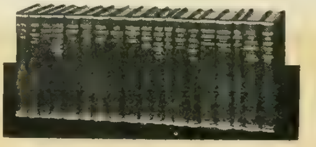

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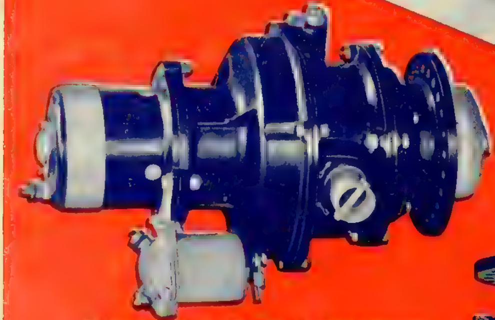

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